

Dr. Howard:

This is the composite
geologic column of
the Upper Oso localities.

All the bird materials
are from the loc. No.

41545

4546

4547

and the general locality
No. for those 3 - 4464.

Rod Raschke

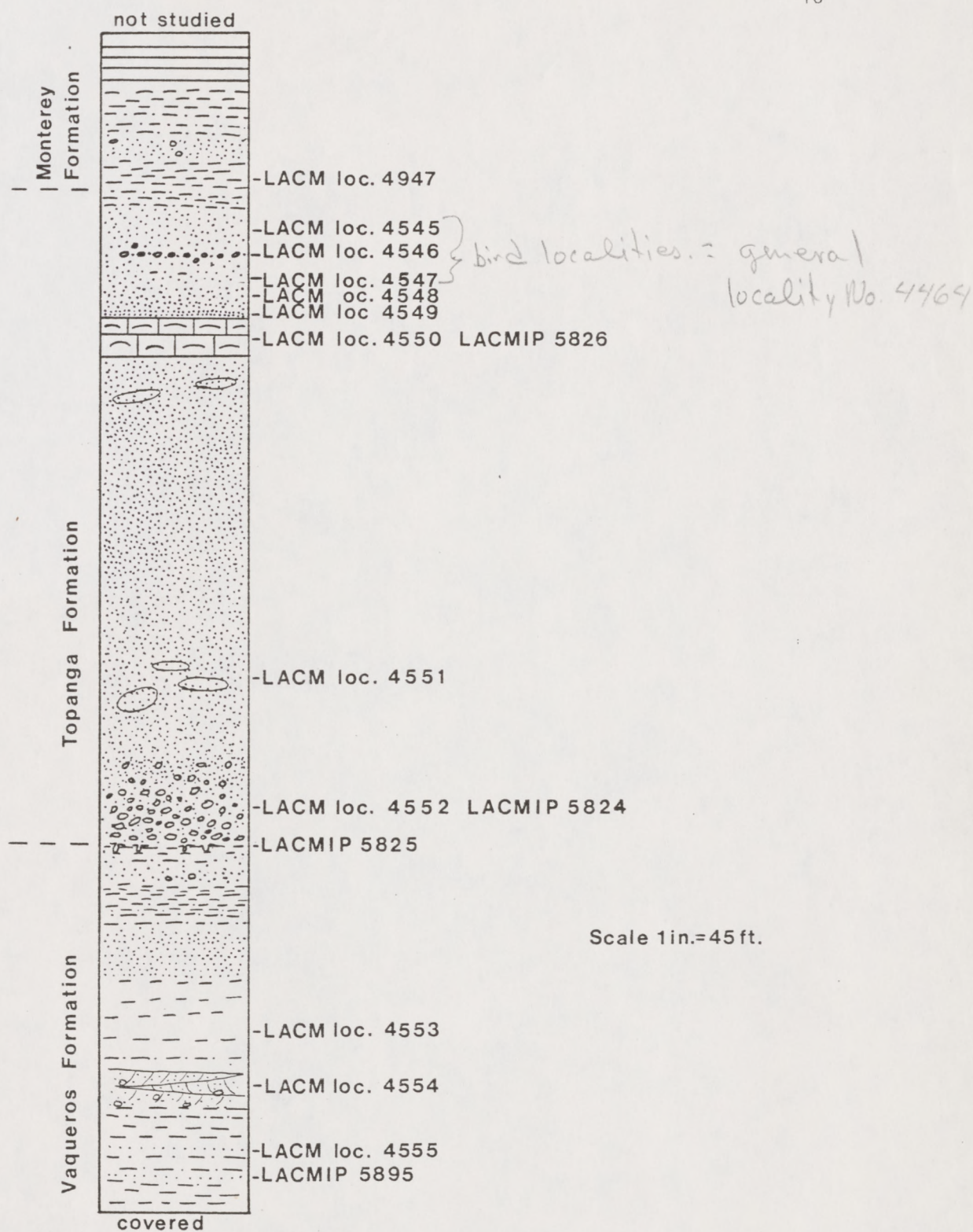


Figure 2. Generalized stratigraphic column, Upper Oso Dam.

Br / distal shaft 11.7 mm
 42/17.1-59.90 46/16.8 79.90 12, 24, 85
 42/15.2 35/15.1-68.90 59/14.3-86.90 38/16.9 55.90
 50.90 Puffinus? n. sp. 5.6/5.9 (6.1/20)
 1 mm

Referred material. From locality LACM 4546: associated complete, but poorly preserved, right humerus, crushed proximal end of ulna and proximal and distal ends of radius, LACM 120422. Collected April 23, 1980 by L.G. Barnes.

Description. The humerus is distinguished from the holotypes of both P. priscus (UCMP 58185) and P. mitchelli (UCMP 58184) (casts of which are at hand) in having a more rounded, less flattened shaft. Length falls between LACM specimens from Sharktooth Hill referred to these species: Oso Dam humerus LACM 120422, 90.4 mm, Sharktooth Hill referred specimens of P. priscus, 80.2-82.2, one referred measurable/specimen of P. mitchelli from Sharktooth Hill, 98.1 mm.

Poor preservation makes difficult detailed comparison with P. inceptor Wetmore 1930, the holotype of which from Sharktooth Hill (cast at hand) is a distal end of humerus ~~32~~ (Cal Acad Sci. 5223). However, the Oso Dam specimen appears to lack the notable internal thrust of the entepicondylar prominence characteristic of P. inceptor and reflected in measurements of distal end: breadth distal condyles, 9.8 P. inceptor, 9.6, LACM 120422; greatest breadth distal end, 12.2 mm. P. inceptor, 11.3 LACM 120422.

Other Miocene members of the genus Puffinus recorded from California, include P. calhouni and P. barnesi from localities in Orange County, and P. diatomicus to the north, at Lompoc, Santa Barbara County. The ~~humerus~~ is the holotype in the Orange County species, and is included in the skeleton of P. diatomicus. The Oso Dam humerus is ~~longer~~ ^{larger} than any of these. It is also broader than the holotype distal end of P. micraulax Brodkorb 1963 from the Early Miocene of Florida. Compared to the holotype humerus of P. conradi Marsh 1970, however, from the Middle Miocene Calvert Formation of Maryland, Oso Dam specimen LACM 120422 is notably smaller. Casts of the Middle

Milne-Edwards
Miocene holotypes of *P. arvernensis* and *P. antiqua* from France are not
at hand.

Discussion. The poor condition of the LACM 120422 specimens precludes naming a species with this as holotype material. Should more material assignable to this shearwater become available, studies should also be made of the French Middle Miocene ^{species} holotypes of P. aquitanicus Milne-Edwards, 1874 and P. antiquus (Milne-Edwards 1874) and ~~The holotype of~~ P. arvernensis Milne-Edwards 1871, redescribed by Shufeldt 1896, is a tarsometatarsus. In fact, Olson (1985:211) has noted the need for a world-wide revision of fossils assigned to this genus.

Miocene holotype

INTRODUCTION

From 1978 to 1983 the Natural History Museum of Los Angeles County collected fossils in Middle Miocene marine sediments exposed in the foothills of the Santa Ana Mountains in the north part of Mission Viejo, Orange County, California (Raschke, 1984). The material was exposed during the grading of hills on both sides of Oso Creek during construction of an earth-fill dam, later named Upper Oso Dam. The subjects of the present study are the 54 bird bones, representing 34 individuals. These are from LACM localities 4545, 4546, and 4547, in descending order of stratification, in coarse sand deposits which have been referred to the Topanga Formation ~~and~~ which underlie shales and siltstones referred to the Late Miocene Puente and Monterey Formations in this area (Morton, et al, 1973). (The Topanga Formation, in its type area in the Santa Monica Mountains, many miles to the north within the Los Angeles Basin, has been upgraded to the status of a group (Yerkes et al, 1979) and the name as a formation is probably no longer applicable in Orange County.) The sediments are older than those of the bird-bearing Monterey Formation that have been previously reported (Howard 1966, 1968, 1976, 1978) from horizons in Laguna Hills (Leisure World) and Laguna Niguel, several miles to the southwest in Orange County, and are roughly comparable in age to the Sharktooth Hill Local Fauna in the Middle Miocene Round Mountain Silt to the north, in Kern County. Fossil avian species have been described from the Sharktooth Hill Bonebed by Wetmore (1930), Miller (1961, 1962), Howard (1966, 1984), and Warter (1976). That deposit is correlated with the Barstovian North American Land Mammal Age, and is approximately 14 to 15 million years old (Barnes, 1977).

Unfortunately, many of the bones from Orange County described here are not only fragmented, but crushed and distorted. Specific identification has, therefore, been difficult. Five families are recognized, with most abundant

XEROX

ABSTRACT. A marine vertebrate assemblage of Middle Miocene age has been recovered from the foothills of the Santa Ana Mountains in Orange County, California. Several localities on both sides of Oso Creek have produced the fossils. Among these fossils, 54 avian bones represent Diomedea ?milleri (albatross), Puffinus priscus, Puffinus ?n. sp., Puffinus spp. (shearwaters), Sulidae (boobies and gannets, 2 species), Anatidae (undescribed large diving duck), and Alcodes ?ulnulus (flightless auk). These comprise the oldest fossil avifauna yet described in the Orange County area, and the only ^{one of} Middle Miocene ^{Bastropia} ~~from~~ south of the outcrops of the Sharktooth Hill Bonebed in Kern County, California. The closest affinities of this assemblage are with birds from the ^{Middle Miocene} Sharktooth Hill Bonebed ~~which is of the same age~~. The primitive flightless auk, Alcodes, is only known elsewhere, however, from slightly younger strata in the Monterey Formation in Laguna Hills, Orange County.

See other sheet

Larry

INTRODUCTION

From 1978 to 1983 the Natural History Museum of Los Angeles County collected fossils in Middle Miocene marine sediments exposed in the foothills of the Santa Ana Mountains in the north^{ern} part of Mission Viejo, Orange County, California (Raschke, 1984). The material was exposed during the grading of hills on both sides of Oso Creek during construction of an earth-fill dam, later named Upper Oso Dam. The subjects of the present study are the 54 bird bones, representing 34 individuals. These are from LACM localities 4545, 4546, and 4547, ^{which are progressively older} in ^{stratigraphic} ^{within the geologic section and are} ~~descending~~ order of stratification, in coarse sand deposits which have been referred to the Topanga Formation. ^{These coarse sands directly underlie} ~~and which underlie~~ shales and siltstones referred to the Late Miocene Puente and Monterey Formations in this area. ^{It is no longer correct to refer to these coarse sands as the Topanga Formation, however.} (Morton, et al, 1973). ^{approximately 100 km?} The Topanga Formation, in its type area in the Santa Monica Mountains, ^{many miles} to the north within the Los Angeles Basin, has been upgraded to the status of a group (Yerkes et al, 1979) and the ^{formational} name as a formation is probably no longer applicable in Orange County. The sediments are older than those of the bird-bearing Monterey Formation that have been previously reported (Howard 1966, 1968, 1976, 1978) from horizons in Laguna Hills (Leisure World) and Laguna Niguel, ^{10 Km} ~~several miles~~ ^{how many Km?} to the southwest in Orange County, and are roughly comparable in age to the Sharktooth Hill Local Fauna in the Middle Miocene Round Mountain Silt to the north, in Kern County. Fossil avian species have been described from the Sharktooth Hill Bonebed by Wetmore (1930), Miller (1961, 1962), Howard (1966, 1984), and Warter (1976). That deposit is correlated with the Barstovian North American Land Mammal Age, and is approximately 14 to 15 million years old (Barnes, 1977).

Unfortunately, many of the bones from Orange County described here are not only fragmented, but crushed and distorted. Specific identification has, therefore, been difficult. Five families are recognized, with most abundant

representation among the shearwaters, family Procellariidae (26 bones, 19 individuals), and the booby-gannet family, Sulidae (22 bones, 10 individuals). Others are of the albatross family, Diomedidae (2 bones of 1 individual), waterfowl family, Anatidae (1 bone) and auk family, Alcidae (3 bones of 3 individuals). At least eight species are represented.

Both the families Procellariidae and Sulidae are well represented in the fossil record, and seven species of Sulidae and eight species of Procellariidae (including 2 fulmars) have been previously described from California's Miocene deposits. A thorough study of each of these families is, therefore, in order. The Sulidae are now in process of being reviewed by Kenneth I. Warheit of the Department of Paleontology at the University of California, Berkeley. Assignments herein of the shearwater and ^{salid}~~booby-gannet~~ material should be considered tentative.

MATERIALS AND METHODS

Acronyms used for institutions are:

CAS - California Academy of Sciences, San Francisco, California.

LACM - Natural History Museum of Los Angeles County, Los Angeles, California.

UCLA - University of California at Los Angeles, California.

UCMP - University of California Museum of Paleontology, Berkeley, California.

UCMVZ - University of California Museum of Vertebrate Zoology, Berkeley, California.

USNM - ~~United States~~ ^{Smithsonian Institution} National Museum of Natural History, Washington, D.C.

In addition to the fossil material in the LACM collections, referred material and casts of types from CAS, UCMP, UCLA and USNM have been available for this study. Modern skeletal material is from the LACM collections, with the exception

XEROX

of specimens of Aethia from UCMVZ. The locality number LACM 4464 is applied to material found as float from LACM localities 4545, 4546, and 4547, but of no precise provenience. Classification follows that of the ^{6th} 1983 edition of the American Ornithologists' Union Checklist of North American Birds. (1983)

SYSTEMATICS

Procellariiformes

Family Diomedidae -- Albatrosses

Diomedea Linnaeus, 1758

Diomedea ?milleri Howard, 1966

MATERIAL. Associated proximal half of right ulna and distal end and shaft fragments of radius, LACM 120439, from LACM locality 4547.

DISCUSSION. Albatross bones have been previously reported from several Miocene age sites in California, but only two species, both from the Sharktooth Hill Bonebed, have been described: Diomedea californica Miller, 1962 and D. milleri Howard, 1966. The holotype of D. californica is a tarsometatarsus, slightly larger than that of the modern albatross, D. albatrus, but not as large as that of D. exulans. D. milleri is of markedly smaller size.

The holotype of D. milleri is ^{the} a proximal end of an ulna with a proximal breadth of 14.4 mm, as compared to 17.6 mm for that of the living D. nigripes (see Howard, 1966:4). ~~The~~ ⁹ ulna, LACM 120439, from the Upper Oso Dam site, measures 15.8 mm. The associated radius is also narrower of shaft than that of D. nigripes. The area immediately distal to the ulnar cotylae, which contains the diagnostic characters of the species D. milleri, is crushed in LACM 120439. However, a clearly defined ridge on the palmar side of the shaft below this area suggests that there was a distinct angle between the palmar and internal surfaces of the shaft immediately below the internal cotyla as described for D. milleri. Although LACM 120439 appears to have a more prominent acromion and external

cotyla than in the holotype of D. milleri, these areas are slightly eroded in the latter.

Family Procellariidae -- Shearwaters

Puffinus Brisson, 1760

Puffinus priscus Miller, 1961

REFERRED MATERIAL. Left humerus, LACM 120415; associated right and left humeri and incomplete right ulna, LACM 120416; distal end of right humerus, LACM 120417; proximal fragment of left ulna, LACM 120424; all from locality LACM 4546. Proximal three-fourths of right humerus, LACM 126159, from locality 4464.

TENTATIVELY REFERRED MATERIAL. Right and left distal ends of tibiotarsi, LACM 120425 (right) and 120426 (left); right tarsometatarsus lacking proximal end, LACM 120419; all from locality 4546.

DISCUSSION. The humeri agree in general conformation, size and flatness of shaft with the holotype ^{is (UCMP 58185)} distal end of this element from the Sharktooth Hill Bonebed and/or additional unpublished specimens (three of which - LACM 18140, LACM 44556 and LACM 126219 - are complete) from the same bonebed ^{that are} now referred to Puffinus priscus. Measurements of the Upper Oso Dam humeri are: length 79.3-81.2 mm, breadth distal condyles 7.4-7.7 mm, distance from distal surface of condyles to proximal surface of ectepicondylar prominence 9.5-9.9 mm. The same measurements ^{of} humeri from the Sharktooth Hill Bonebed assigned to P. priscus are: length 80.3-82.5 mm, breadth distal condyles 7.1-7.7 mm (holotype 7.5 mm), and distance from distal condyles to proximal surface of ectepicondylar prominence 8.9-10.0 mm (holotype 9.5 mm).

^{Each of} The two ulnae, one of which is associated with humeri LACM 120416, have a high, pointed olecranon (possibly exaggerated by crushing in this area) and long, pointed and upturned external cotyla. These characters are suggestive of those of modern P. opisthomelas, though to an exaggerated degree.

Although in general characters, The humerus resembles
That of members of the subgenus Puffinus, ^{its shaft is more rounded,} ~~it is less~~
flattened, throughout. It is therefore notably distinguishable
from the holotype of P. praeus, and slightly less so
from the holotype of P. mitchelli ~~in having a more~~
~~rounded, less flattened shaft.~~

The tarsometatarsus, which measures 6.1 mm in distal breadth, is tentatively assigned to P. priscus on the basis of favorable comparison with tarsometatarsi from the Sharktooth Hill Bonebed. Of the three Puffinus tarsometatarsi³ now available from the latter locality, one incomplete distal half (LACM 104058), which agrees in size with LACM 120419 from Orange County, is slightly smaller than the other two, and I believe is assignable to P. priscus.

The tibiotarsi resemble the only distal end of this element that has been found in the Sharktooth Hill Bonebed, LACM 122994, a specimen which is tentatively referred to P. priscus on the basis of its size relative to that of the tarsometatarsi noted above.

^{7 n.}
Puffinus sp., possibly undescribed
^

REFERRED MATERIAL. Associated, complete, but poorly preserved right humerus, crushed proximal end of ulna and proximal and distal fragments of radius, LACM

120422, from locality LACM 4546; collected 23 April 1980 by L. G. Barnes. ^{three} ~~Although in general characters the humerus resembles that of the subgenus Puffinus, it~~
DESCRIPTION. [^] ~~The humerus is~~ ^{notably} distinguishable from the holotype of P. priscus Miller, 1961 (UCMP 58185), ^{and slightly} but less so from the holotype of P. mitchelli Miller, 1961 (UCMP 58184) (casts of ^{both holotypes} which are at hand) in having a more rounded, less flattened shaft. In length, it is intermediate between specimens from the Sharktooth Hill Bonebed referred to these species; LACM 120422, 90.4 mm;

Sharktooth Hill P. priscus ^{three of} specimens 80.2–82.5 mm, one measureable specimen of P. mitchelli (LACM 17500) 98.1 mm. ^{Although} ~~The ulna is severely crushed and measures only~~ ^{the breadth} ~~7.0 mm across the cotylae.~~ ^{could not have exceeded 7.5 mm.} ~~The olecranon is crushed to a point.~~ ^{The distal fragment} ~~of radius is well preserved and measures 8 mm in breadth.~~

DISCUSSION. Poor preservation of the Upper Oso Dam humerus makes difficult any detailed comparison with P. inceptor Wetmore, 1930, ^{of which a} ~~cast of the holotype~~ ^{IC} distal end of humerus of P. inceptor (CAS 5223) is available. The Upper Oso Dam specimen is broken through the internal condyle, but appears to lack the notable

internal thrust of the distal end which is characteristic of P. inceptor, and is reflected in the measurements given by Wetmore (1930:87): breadth of shaft 5.9 mm, greatest distal breadth 12.2 mm. In the Upper Oso Dam humerus, the shaft breadth is 6.3 mm, distal breadth 11.2 mm.

Other Miocene members of the genus Puffinus recorded from California include P. diatomicus Miller, 1925 from the Late Miocene Sisquoc Formation in Santa Barbara County, in which the humerus is included in both the holotype and referred skeletal impressions. Miller recorded the length of these humeri as 80-84 mm (considerably smaller than LACM 120422). The humerus is also the holotype of ~~the~~ ^{one of} the two previously named Late Miocene Orange County species, P. calhouni Howard, 1968 and P. barnesi Howard, 1978. Both are smaller and have a more compressed shaft than does LACM 120422. Compared with the holotype ^{ical} distal end of ^{numerous of} the Early Miocene P. micraulax Brodkorb, 1963, from Florida, LACM 120422 is broader. The holotype ^{ical} distal end of humerus of P. conradi March, 1970, from the Middle Miocene Calvert Formation of Maryland, is broader and has a heavier shaft. *To which modern species, or species-group, of Puffinus is the fossil most similar?*

The poor condition of LACM 120422 precludes naming a species with this material as the holotype. Should more specimens assignable to this shearwater become available, comparisons should also be made of the French Middle Miocene species, P. aquitanicus (Milne-Edwards, 1874), P. antiquus (Milne-Edwards, 1874) and P. arvernensis Milne-Edwards, 1971, redescribed by Shufeldt, 1896. In fact, Olson (1985:211) has noted the need for a world-wide revision of fossils assigned to the genus Puffinus. *Cheneval (1984) [see "note added in proof" in Olson 1985:238] has removed P. arvernensis to Puffinus in the Diomedidae.*

Puffinus spp.

REFERRED MATERIAL. Complete right ulna, LACM 120420; distal 3/4 left ulna, LACM 124360; proximal and distal ends of right ulna, LACM 120421; fragment of proximal end of left ulna, LACM 126155; associated fragments of distal end of

XE R0X

ulna and proximal end of radius and carpmetacarpus, LACM 126156; complete radius, LACM 120423; right caropmetacarpus, LACM 120419; associated fragments of distal end of left ulna and tarsometatarsal shaft, LACM 126157; all from locality LACM 4546. Distal fragment of radius, LACM 120412; incomplete right humerus, LACM 126160; both from locality LACM 4464.

DISCUSSION. Size alone suggests that at least two species are represented ⁱⁿ ~~by~~ this material. Most of the specimens are of the small size suggestive of P. priscus. One poorly preserved humerus (LACM 126160) and one ulna (LACM 120420) are, however, notably larger. The humerus has been partly restored, but appears to have a more flattened shaft toward the distal half of the bone than do humeri of P. mitchelli from the Sharktooth Hill Bonebed. The length of this poorly preserved humerus, from proximal edge of brachial impression to head is 83.2 mm. The same measurement of a Sharktooth Hill humerus, LACM 17500, referred to P. mitchelli, is 86.6 mm. The ulna, LACM 120420, has a length of 95.7 mm. By contrast, the longest ulna known from the Sharktooth Hill Bonebed (LACM 124359) measures only 88.2 mm. Both are markedly larger than the incomplete Upper Oso Dam ulna (LACM 120416) ~~which is~~ ^g associated with the humerus assigned herein to P. priscus.

ORDER PELECANIFORMES

Famile Sulidae -- Boobies and Gannets

Sulidae, spp.

REFERRED MATERIAL. Associated right and left humeri, ulnae, and badly ^{can any of this material} ^{at least be assigned to genus at} ^{this point; it would make the Hcom} ^{more} ^{and more} ^{easy} ^{cited} crushed radius, LACM 120433; associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432; proximal end of radius, LACM 120429; proximal end of humerus, LACM 120430; distal end of humerus, LACM 120431; skull fragment, LACM

120427; all from locality 4546. Associated incomplete radius and ulna, LACM 120438; humerus, LACM 123910; seven associated incomplete and poorly preserved bones lying together in matrix with the following elements represented: incomplete mandible, proximal end of right humerus, three fragments of left humerus, fragment of left ulna, distal end of right radius, proximal end of left radius overlying left carpometacarpus, LACM 126161; all from locality LACM 4547.

DISCUSSION. This material will be included in Warheit's study of the family Sulidae. In my brief examination of the material from Upper Oso Dam, I noted two humeri (LACM 120433, 120431) ^{that} ~~which~~ exceed in measurements specimens of Morus vagabundus Wetmore, 1930, the only sulid species described from the Sharktooth Hill Bonebed. The distal breadth of the holotype of M. vagabundus is 18.3 mm; the same measurement in LACM 120431 is 21.0 mm; length of referred humerus of M. vagabundus, 170 mm (Howard 1966:6), length of LACM 120433, 183 mm. On the other hand, the Upper Oso Dam specimens, LACM 120428, 120432, and 120438, though difficult to measure exactly, suggest a smaller species.

That more than one species of sulid occurs in the Sharktooth Hill Bonebed was noted by Miller (1961:401), who reported a proximal fragment of ulna of larger size than the one referred to M. vagabundus by Wetmore (1930). Also, Howard (1966:7) recorded two tarsometatarsi ^{that} ~~which~~ ^{from M. vagabundus or each other} differ in qualitative characters as well as in size.

ORDER ANSERIFORMES

Family Anatidae -- Ducks, Geese and Swans

Subfamily Anatinae -- Ducks

Tribe Mergini -- Divers

REFERRED SPECIMEN. Distal end of left femur, LACM 125994, from locality LACM 4546, collected by Museum field party, 1981.

XEROY

DESCRIPTION. The fibular condyle is thrust laterally, and there is a deep angular depression above the condyles, posteriorly, as in diving ducks such as those of the genera Somateria, Mergus and Melanitta, but the specimen is markedly larger than in living species of these genera. The breadth of the distal end is 20.7 mm.

DISCUSSION. This femur represents a large diving anatid, goose-like in size, and in general conformation suggestive of undescribed specimens of femora from the Sharktooth Hill Bonebed. It is, however, more slender, and the muscle scar on the internal side of the posterior face is more proximally placed. Anteriorly the intercotylar area appears to be more deeply excavated, but allowance must be made for the poor preservation of the specimen.

The femora and other related elements of the skeleton from the Sharktooth Hill Bonebed are still under study (Howard, in preparation). It is anticipated that a new species, and probably a new genus, will be proposed. The single femur from Upper Oso Dam indicates the presence of a large diving anatid in the Orange County area at the same time as the existence of such a bird--probably congeneric, but specifically distinct--in the Kern County area.

ORDER CHARADRIIFORMES

Family Alcidae -- Auks et al

Genus Alcodes Howard, 1968

Alcodes ulnulus Howard, 1968

MATERIAL. Left ulna, LACM 120434, from locality LACM 4546; left humerus, LACM 120414, from locality LACM 4545; right coracoid, LACM 121010, from locality LACM 4547.

DESCRIPTION. The holotype of Alcodes ulnulus is a complete left ulna (LACM 18277), and ^{the} distal end of a right ulna (LACM 18279) and the proximal end of a

XERN

right carpometacarpus (LACM 18278) ^{were also} ~~are~~ referred to the species (Howard, 1968). An incomplete proximal portion of a right ulna (LACM 18280), ten percent larger than the holotype, was tentatively referred to the species in the same publication.

The ulna from Upper Oso Dam is not as well preserved as the holotype, but resembles it ⁱⁿ ~~by~~ having a relatively heavy shaft for such a short bone. It is, however, slightly longer, and relatively narrower than the holotype. In contrast, the ulna from a Recent specimen of the Least Auklet, Aethia pusilla (UCMVZ 60629), is longer and narrower, and that of the Pliocene flightless auk-like swimmer, Mancalla milleri Howard, 1966, is shorter and broader. Although Alcodes had evolved in the direction of flightlessness, it is clearly not as derived as Mancalla.

The humerus, LACM 120414, though incomplete, resembles the paratype ^{real} specimen LACM 2813 of the Pliocene Mancalla milleri Howard, 1970, in the compression of the distal end and in the height of its ectepicondylar prominence. The deltoid crest, however, is not as extensive as in M. milleri, and the shaft is narrower throughout. Other distinctive characters, peculiar to the Upper Oso Dam specimen are: proximally the pectoral attachment and external tuberosity are distinctly external to the capital shaft ridge and separated from the ridge by a depression, and the ridge is more angular; the depression below the head, internal to the capital shaft ridge extends distally to the line of the distal edge of the incomplete bicipital crest. The bone is too poorly preserved for accurate measurements.

The coracoid from Upper Oso Dam resembles that of M. milleri in its straight shaft and narrow sternal facet. It is, however, shorter than the smallest known coracoid of M. milleri, and is further distinguished as follows: triosseal canal angular at the anterior edge, with tip of furcular facet projecting farther anteriorly; anterior surface of shaft evenly rounded throughout its length.

lacking the flattening and internal projection, distally, characteristic of M. milleri. Greatest length 34.3 mm; M. milleri minimum (Howard, 1970:8), 38.5 mm.

DISCUSSION. These three bones represent the only alcid material collected from the Upper Oso Dam localities. No species of the family Alcidae has ever been found in the contemporaneous Sharktooth Hill Bonebed, but at least five genera are represented among the 27 alcid bones recorded (Howard, 1968) from the lower part of the geologically younger Monterey Formation (Leisure World site, LACM locality 1945), the type locality of Alcodes ulnulus. The genus had not been previously recorded elsewhere.

As originally described, Alcodes was placed, somewhat questionably, in the subfamily Mancallinae because of its apparent adaptations to flightlessness. More recent surveys of the flightless alcids has led Olson (1985) and Chandler (in lit.^t) to question the need to recognize a subfamily^g distinction (Mancallinae^{ial}) even for Mancalla.

CONCLUSIONS

Fossil marine birds have been discovered in a vertebrate assemblage in Middle Miocene rocks at Upper Oso Dam, in Mission Viejo, that underlie the Monterey Formation, the source of most^{of the} previously described Late Miocene birds in Orange County, California. These fossils are from a coarse clastic unit referred to the Topanga Formation. The poor preservation of the avian material from the Upper Oso Dam site has made difficult the specific assignment of the 54 avian bones represented. They are, however identifiable as follows (number of bones in parentheses):

Family Diomedidae -- Albatrosses

Diomedea ?milleri Howard, 1966 (2)

Family Procellariidae -- Shearwaters, et al.

Puffinus priscus Miller, 1961 (10)

Puffinus (?n.#sp.) (3)

→ for consistency, this list should agree with the text heading -- or vice versa.

Puffinus spp. (13)

Family Sulidae -- Boobies and Gannets

Sulidae, two spp. (22)

ditto

Family Anatidae -- Water Fowl

Tribe Mergini, genus and species undetermined (1)

ditto

Family Alcidae -- Auks, et al.

Alcodes ?ulnulus Howard, 1968 (3)

connected with introduction?
 *The age of the sandstone deposits bearing these fossils at Upper Oso Dam is considered to be approximatey correlative with the Sharktooth Hill Bonebed in the upper part of the Round Mountain Silt in Kern County, California, ~~Therefore~~ special attention was given to comparison of the avian material from that site, which contains more than twice the number of bird bones represented at the Upper Oso Dam site.

Of the nine avian families now recognized (Howard, 1984) in the Sharktooth Hill Local Fauna, only four are represented at the Upper Oso Dam site. The albatross is questionably assigned to P. milleri, known from Sharktooth Hill. One species, the shearwater, Puffinus priscus, definitely occurs at both localities. It is possible that one or both of the other species of Puffinus described from Sharktooth Hill are also represented in the material assigned to this genus from Upper Oso Dam.

The sulid bones suggest the presence of two species at the Orange County locality, as in the Sharktooth Hill Bonebed. It is anticipated that Kenneth I. Warheit's study of this family, now under way at the University of California, Berkeley, will result in more definite identification. *Already stated elsewhere.*

A single anseriform femur documents the occurrence at Upper Oso Dam of a large diving anatid distinct from the previously named Sharktooth Hill species, Presbychen abavus Wetmore 1930, but at least congeneric with an undescribed species from the same bonebed in Kern County (Howard, in preparation).

Of particular interest are three bones of a species of Alcidae assigned to the primitive, flightless auk, Alcodes Howard, 1968. No specimens representing the Alcidae have ever been found in the Sharktooth Hill Bonebed. The genus Alcodes is, however, well represented in the younger, Late Miocene Monterey Formation, exposed nereby in Laguna Hills, Orange County (LACM locality 1945, the type locality of Alcodes ulnulus).

The fossil bird assemblage from Upper Oso Dam is the oldest known in Orange County and the only Middle Miocene one yet described from California aside from that in the Sharktooth Hill Bonebed, approximately 200 miles to the north. This is also the southern-most documented occurrence of Middle Miocene marine birds in western North America. The Orange County site is on the opposite side of the San Andreas fault from the Sharktooth Hill Bonebed, and, accounting for prior lateral displacement, might have originally been considerably farther south in Middle Miocene time. This may explain why flightless auks have never been found in the Kern County fossil record but are relatively common in Orange County. The group may have been tropical or might have had a more southerly distribution.

This material
has been
reworked &
copied

Oso Dam

priscus a small species nearest in length
to *opisthomerus* species but bone heavier

June 26 85

Avian Fossils from Upper Oso Dam localities

LACM Locality 4464 (1), 4545 (1), 4546 (37), 4547 (13) Loc. ? (2) 4464(1)

54

Procellariiformes

Family Diomedidae -- Albatrosses 2 bones, 1 individual

- ✓ 2 (1) *Diomedea* sp. Loc. 4547, no. LACM 120439; right associated proximal end ulna and distal end with shaft fragments of radius. Collected April 12, 1979.

Possibly *D. milleri* though slightly larger. Two species of *Diomedea* were described from Sharktooth Hill (*D. milleri*, small, *D. californica*, large).

26 Family Procellariidae -- Shearwaters etc. (4546(23); 4464(1) loc ?(2))

Genus *Puffinus* 24 bones, 19 individuals

Locality 4546 → 23 bones, 12 indiv. See below also

P. priscus

- ✓ no. 120415 nearly complete humerus left
- ✓ 3 (1) no. 120416, associated left and right humeri and right ulna
- ✓ 120417 distal end of right humerus
- ✓ 120419 nearly complete right tarsometatarsus length 50mm (prox. ulna)
- ✓ *P. ?n. sp.* between *priscus* and *mittchelli* in length 90.5mm (mittchelli 83mm, *priscus* 80.8-82.7)
- 3 (1) ✓ no. 120422, associated right humerus, proximal end ulna and proximal and distal ends of radius. (sp. ? 84mm, Kullin's Shearwater 81.4)

P. sp.

- ✓ no. 120420 complete right ulna sp. ? very long
- ✓ no. 120421 fragment of right ulna size fits *priscus*
- ✓ no. 120423 proximal end radius complete (when 2 pos placed together)
- ✓ no. 120424 proximal fragment left ulna size fits *priscus*
- ✓ no. 120425 distal end tibiotarsus right br dist 6.4mm
- ✓ no. 120426 two distal ends tibiotarsus left 8.6.0mm
- ✓ no. 120418 right carpometacarpus small size suggests *priscus* 42.4 (42.3-46.3)

Locality not given 9 bones, 6 indivs.

✓ *P. priscus* uncatalogued, prox. end humerus (Raschke, Sept 78)

✓ *P. ?n.p.* uncatalogued humerus (Rasche) (right)

P. sp.

2 Loc. 4546 uncatalogued associated fragments prox. tarsometatarsus, distal ulna (Mus. party Apr. 23, 1980)

1 4546 uncatalogued incomplete proximal end ulna (Joan Brown Apr, 1980)

120430 uncatalogued incomplete distal end left ulna (Barnes 1976)

4546/120430 uncatalogued prox. radius, prox. carpometacarpus, distal ulna (right)

1 4546 sp. Barnes 1# 3190 Loc. 4546 radius

(3) 4546 Locality 4464 1 bone

no. 120412, distal fragment of radius *Puffinus* sp. Size = # 120423 = ?

The only species found ~~xxx~~ at Sharktooth Hill that I feel safe in identifying from Oso Dam is *P. priscus*. The holotype is a distal end of humerus and there are one or two complete humeri at Sharktooth now referable to *P. priscus*. There is one long ulna at Oso that might be of the other Sharktooth species, *P. mittchelli*, but this needs more study. The third Sharktooth species, *P. inceptor* is not clearly recognized in anything except the holotype, which is only a distal end of humerus, not too well preserved.

Mitchell's Shearwater suggesting *priscus*
flatter shaft than *creatorum* (even
than *priscus*)

Loc	Species
Oso	Sharktooth Hill
priscus	priscus
81.2	82.5
120416	uncat
	80.7

opisthomerus humerus
82.8 - 84.3 humerus
558 86.3
74.1 75.9 ulna
42.3 46.3 carpus

diomedea 4546

Loc 4954 *Parvus* from Shallock
 #17500 44438 15140

Mitchell Shallock
 #17500 10-13-31

Length	80.7	80.3	82.7	92.0	
Stretch	7.4	7.3	7.4	9.4	8.7
dist shaft	3.1/6.0	3.3/6.5	3.4/6.7	4.2/6.6	4.2/7.2

Parvus? from USO

	12043	12046
Length	79.3	81.3
Stretch	7.6	7.6 8.3
dist shaft	3.8/6.1	3.2/6.4 3.0/6.6

also to 7.2
 dist 7.6

dist data *Parvus* from 1945
 #17523 dist 6.7.0
 dist/dept shaft
 3.3/3.7

Parvus mitchell from Shallock
 123554 dist 6.6.8+
 length 33/33

98476 dist 6.8-7.0?
 3.3/3.7 B. dist shaft

FAMILY Sulidae -- Boobies and Gannets 22 bones, 12 individuals

?Sula willetti, Miller

- Locality 4547 (10)

?Sula willetti Miller

- Slab
sticker

0fxtxhxbftxhnxnxssixnnxtxtxhxnennsxMorus

4548 always i

4547 Rimmed 2. (1 inst) Alcedo !
Subdue 10.

4546 23 Puffins (19 adults
1 marginalis (1 mt)
1 alcedo.
12 subd.

Loc. 7. 2 Puffins

Число 1000000

RR 400

19 September 1978

Upper Oso Dam

East abutment, upstream side.

~~AA~~ ~~5E~~. General locality Number.

Brown Sand Topanga Fm.

Pinniped tooth, bird bone and
whale jaw.

Locality is 20 feet $\pm$ below
spillway.

RR 431

27 November 1978

Upper Oso Dam - sm. borrow - lower part.

Bird bone

Tt - brown Ss.

LACM 4464

Need
Numbers

Raschke 400 - farm locality ?? and number for specimen

Proximal $\frac{3}{4}$ right humerus

loc
4444

Assigned to Puffinus puffinus Miller 1961 ✓

From locality 4546

① Fragment of proximal end left ulna. Coll'd Joan Brown
23 April 1980 ✓

② Associated distal end of ulna and proximal
fragments radius and carpometacarpus
Barnes 3190

③ Associated fragments + tarsometatarsus shaft and
distal end left ulna. Barnes 3196, unidentified
Other fragments

④ Locality uncertain, Raschke 431
nearly complete left humerus unnumbered

Assigned
"Puffinus sps."

loc
4444

Home
April 28, 1945

Chuck Piffner
1945

B So Dam
250 016m
check undat? 7 sp.
D. mulleri? 26m (1)

check white
in 1945 arsenic
5 P. pices
1945 17547 shot - pos
200 lines
? 1945
Dionaea sp.

check fairsi Piffner
to 1941
Shenhook L. 13 sp. 120 to 130
reputed on

Dionaea californica
Dionaea mulleri

Pagrus Miguel
Gavia brodiahi
Dionaea 3 calif.
Dionaea sp. indet
smaller

*Puffinus bairdii

Puffinus m. ceptor
Puffinus pacificus
Puffinus mitchelli

Puffinus sp.
58 P. pacificus?
P. californicus ✓

P. pacificus 7 (5) 23 (15)
P. species? new 3 (1)
P. sps. 13 (9)

Oceanodroma sp.

Halimastur micans

H. harrisi

Morus longicauda

*Morus magnus

Morus mitchelli?

Osterodroma

Morus vagabundus
Morus sp.

27 { m. longicauda
m. mitchelli?
m. magnus?
= m. mitchelli?
O. : ori

M. vagabundus?
~~Sula~~ ? mitchelli? 5 (3)
Morus sp. 5 (1)
Sulidae 11 (5)
2 (9)

Ciconiidae seme?

Megapalaeus?

Presbyther abamus
Branta sp.

Presbyther abamus Presbyther? 1 (1)
~~Branta~~ sp.

Recurvirostra

Una sp.
2 Aethya sp.
ulna

A. nassimovi

length 28

sh. 1.7

m. diff. 2.0

diff. 3.9

q. dist. 3.1

diff. 3.2

Prunella

Sulidae

alcus

36.9

2.9

4.5

7.5

5.7

3.8

5.4

Alca

Certhia

Aethya nassimovi

Alcedo ulmulus Alcedo? 3 (3)

Prunella

Check Microsela Bones, to
cast of type of Sula welleri.

Sula? { 120428 (25)
120432 (10)
120438 (2)

muss sp. 120433 (5)

unmat (7)

120421 1

120420 1

120431 1

120429 1

Uncatalogued Oss Dam

Same
as p. 3
and
typed on
p. 16

typed Puffins ? *parvus* distal $\frac{3}{4}$ ulna Barnes 1976
 typed 2 Puffins distal *febr* Barnes 1876 (coll Barnes)
 typed Puffins *parvus* *ulna* Joan Bron Coll. 23 Apr 1980
 typed P. *parvus* *parvus* $\frac{3}{4}$ Barnes Post RR 400 19 Sept 1978
 typed Puffins sk m. compact *ulna* RR 431' no dat
 typed Puffins sk *frag* *tan*, *ulna* Mus Post 23 Apr 1980
 typed Puffins sk *frag* *ulna* *nab* Barnes 3190 4546
 Davis goose distal left *ulna* Mus Post Aug 1981
 In separate tran - *Alcedo* *frag* *Shel*. *Sulida* Aug 9, 1981
 Loc 4547 ~~RR 535~~ 535 or 535?
~~note~~ See white sheet for detail

SYSTEMATICS

ORDER PROCELLARIIFORMES

Family Diomedidae-- Albatrosses

Diomedea ? milleri Howard 1966

Material available.-- Associated proximal end of ulna and radius LACM locality 4547 no. 12009. Collected April 12, 1979 by B.J.W.
 120439

Discussion. The holotype of Diomedea milleri is a proximal end of ulna, smaller than the minimum for D. nigripes (D. milleri proximal breadth 14.4 mm, D. nigripes 17.6 mm). The ulna from locality 4547 is slightly broader, but still ~~broader~~ narrower than that of D. nigripes. The radius is also narrower than that of D. nigripes.
 (15.4 mm) than the holotype

NOTE: Check characters defined for milleri: i.e. HH1966 p. 4" shaft below internal cotyla forming distinct angle between palmar and internal surfaces; brachial impression well depressed and distinctly delimited at its proximal tip by the prominent, broad surface of the attachment of the anterior articular ligament; the latter attachment relatively short, not extending distally beyond level of distal edge of proximal radial depression."

Family Procellariidae -- Shearwaters

Puffinus priscus Miller (1961)

Material available. Locality 4546 no. 120416; right and left humeri proximal end of left? ulna, collected by La Barnes, January 11, 1979. no. 120415 right? humerus.

Discussion. The humeri agree in distal breadth across the condyles with the ~~type~~ holotype distal end of humerus from Sharktooth Hill; length also agrees with Sharktooth Hill humeri assigned to P. priscus. See Table

	holotype priscus	Sharktooth Hill No. 44658	no. 18140	Oso Dam no. 120416
Dist. br	7.3 mm	7.3	7.5	7.6
length int		80.5	81.6	81.3

1. Puffinus priscus Miller

Material.-- Nearly complete right humerus locality 4246, no. 120415.

Measurements.-- Length 79.3 mm; distal breadth of condyles 7.35 (holotype P. priscus 7.5mm); depth distal end (internally 8.6mm ((area broken in holotype); distance from external condyle to top --prox. surface-- of ectepicondylar prominence 9.5 mm (holotype 9.5 also). The shaft is broken and mended so measurements are not dependable 4.1/6.1 (holotype 3.2/6.1

2. Right and left humeri and proximal end of right ulna from locality 4546, no. 120416.

Measurements.-- length 81.2 mm and 81.7 mm ~~XXXXXXXXXXXX~~ humeri

br. dist. condyles 7.7 and 7.5 mm (holotype 7.5)

depth int condyle 8.8 and 8.8 (holotype ~~8.8~~broken)

dist. from condyle to top of ectepicondylar prom 9.5 & 9.9 (holotype 9.5)

Breadth/depth shaft 3.3/6.4 and 3.1/6.6 (holotype 3.2/6.1)

3. P. ? priscus incomplete (distal half) humerus loc. 4546, #120417

Measurements dist. br. condyles 8.0 (holotype 7.5)

breadth/depth shaft 3.0/6.4 (holotype 3.2/6.1)

Continuation of 120416 -- ulna: Measurements

proximal breadth 7.1 depth 7.6

15' 2 12 mid

June 11, '85-

Puffinus sp.
LACM

REFERRED MATERIAL. From locality 4546: Complete right ulna
no. 120420; / proximal fragment left ulna no. 120424; / fragment right
ulna no. 120421, / uncatalogued incomplete (prox.) ulna (Joan Brown);
uncatalogued 3/4 distal left ulna (Barnes 1976); proximal fragment
radius no. 120423; distal fragment radius 120412; uncatalogued proximal
end of radius, ~~xxx~~ distal end ulna and proximal end carpometacarpus
(Barnes 3190); two distal ends tibiotarsi nos. 120425 and 120426;
right carpometacarpus no. 120418; uncatalogued ~~frag~~ associated fragments
proximal tarsometatarsus and distal ulna (Mus. Party, Apr. 23, '80) gr.

DISCUSSION. In modern species of Puffinus, the ulna varies from ^{in length} ~~86 percent~~ 91 percent to 104 percent of the humerus. Ulna no. 120420 (with a length of 95.7 mm) is 97.5 percent of the length of ~~of~~ humerus no. LACM 17500 from Sharktooth Hill assigned to Puffinus mitchelli and 118.1 percent of the humeri from either Oso Dam or Sharktooth Hill referred to P. priscus. It exceeds ~~ix~~ the longest ^(#124359) which measures 88.2 mm) ^{mm} The ~~same~~ ^{same} (124359) complete ulna from Sharktooth Hill/by 7.5 ~~mm~~ ^{mm} ~~this longest ulna from STH~~ approx. 890 is ~~82~~ percent of the length of the humeri assigned to P. mitchelli.

Puffinus ?n. sp.

REFERRED MATERIAL. Associated complete (but crushed) right humerus, proximal end of ulna (badly crushed) and proximal and distal ends of radius, ~~uncatalogued (R. Rasche 431)~~ from locality 4546 (no. 120422; uncatalogued (R. Rasche 431) humerus

Sept. 1

Procellariidae - cont'd from p. 1

? *Puffinus priscus* continued from p. 1
typed ✓ 1 Proximal end of humerus. Rod Raschke (400) 19 Sept. 1978

Puffinus sp. continued from p. 1
typed ✓ 1 ulna ✓ Barnes 1976 dist end loc.?
typed ✓ 3 dist ulna + prox radius + prox carponotaculum loc 4546 Barnes 3190

typed ✓ 1 prox ulna loc 4546 Joan Barn 23 Apr 1980

typed ✓ 2 dist ulna, prox tarsometatars. loc. 4546 Apr 23/80 mus full path

Aves doubtfully *Puffinus* typed ✓ 1 dist tibia loc 4547 R. Raschke 11 Jan. 1979 Barnes 3190

typed ✓ 1 Nearly complete humerus. Raschke (431) loc? date?
Puffinus n. sp.? Suggest *Suilash* to 120422

Size and characters suggest at least two species

Puffinus priscus or

Larger sp. but not same as 'humeri assigned & mitchelli from Sharktooth Hill, and seemingly larger than than in cepter.

ulna 6.7 x 8
dist 6.5 depth 8.3
95.7 length 1120428
(Sharktooth loc 88.2)
prox 7.5 x 9.1
dist 6.2 depth

could be mitchelli or very young humeri?

The above omitted ulna in the SH 4 coll. mitchelli is uncalibrated & labeled 4934 - 594-14 & shorter. Which is mitchelli? OSO #120420

But mitchelli doesn't seem to be present at least in the humeri area.

There are left + right humeri (#17500) assignable to mitchelli at Sharktooth Hill (match distal type very well).

Not only are these larger than any of the humeri assigned to priscus at OSO Dam but they do not agree with larger OSO Dam humeri # unat. (RR 431) and 120422

These two have a much shorter bicristal crest greater excav. below head & very high sharp central ridge. It is doubtful, however that even these two rep the same sp.

The Sharktooth (RR 431) is deeper & flatter & the bicristal crest more rounded, also bone is longer than 120422. The 1st sheph 120422 is about same width as the distal end lacks the int flange & depth

Check bones

♂ ? *Alcedo ulmulus?*

~~and~~ ♂ ~~is~~ flattened?

2.6 / 5.0
or depth

at middle of skull

Gave uncatbird
+ adult skeleton

"
" *Alcedo*
" *ulmulus*

♂ 10/10/10

Also see notes on
O.S. Dam material in
yellow tablet

29
indus
40 bones

List of specimens of birds collected Dec 17, 1979 - Dec 18, 1984
in boxes 4545, 4546 & 4547, in remnants of marine
sediments left on the east side of the lake behind Oso Dam
after grading. The site was previously hill

- X 120412 ✓ Puffin dist radius loc 4544 collected May 7, 1980? See 120423 MS
- X 120413 ✓ sh? skull loc. 4545 Jan 3, 1980 Bird? NO 4545
- ✓ 120414 ✓ Alcedo left humerus loc. 4545 Jan 3, 1980 4545 MS
- ✓ 120415 ✓ Puffin humerus loc 4546 NOT in MS ✓
- ✓ 16 ✓ " " " " " " MS 3 bones
- ✓ 17 ✓ " " " " " " MS
- X 18 ✓ " " " " " " MS
- ✓ 19 ✓ " " " " " " MS
- X 20 ✓ " " " " " " MS
- X 21 ✓ " " " " " " MS
- X 22 ✓ " " " " " " MS
- X 23 ✓ " " " " " " MS
- X 24 ✓ " " " " " " MS
- X 25 ✓ " " " " " " MS
- X 26 ✓ " " " " " " MS
- X 120427 ✓ Sulidae skull MS CALL SULIDAE ON LOAN 4546 MS
- ✓ 28 ✓ " " " " " " MS
- ✓ 29 ✓ " " " " " " MS
- ✓ 30 ✓ " " " " " " MS
- ✓ 31 ✓ " " " " " " MS
- ✓ 32 ✓ " " " " " " MS
- ✓ 33 ✓ " " " " " " MS
- ✓ 120434 ✓ Alcedo Alcedo left ulna 4546 collected Apr 23, 1980 MS
- X 35 ✓ " " " " " " MS
- X 36 ✓ " " " " " " MS
- X 37 ✓ " " " " " " MS
- X 120438 ✓ Sulidae assoc. radius ulna 4547 MS
- X 120439 ✓ " " " " " " MS
- X 120440 ✓ " " " " " " MS

unnumbered O.S. Dan box

✓ ~~Puffinus~~ humerus (RR 400) Sept 29, 1978 pinnus? loc 3

puffin ✓ Dist ulna (LGB 1978) pinnus? ulna hand & diaphysis if incomplete loc 3

~~confused ulna Sept 11th. Shal. with Hile loc 4956~~

✓ distal tibial Puffinus? ^{over sp?} loc Barnes 1874 coll by BOR Jan 11, 1979 loc 4547

123910 ✓ Validus humerus — [to wait until Dec 84]

✓ prox ulna Puffinus de Joan Barnes Apr 23, 1980 loc 4546

✓ humerus Puffinus sp? RR 431 loc 7

Cultrius?
See p 9
Shal

~~See white sheet~~

✓ page dist ulna, prox radius, prox carpus (w/c) Barnes 3190 loc 4546

✓ page dist ulna, tarsal shaft and 2 other fingers Musp. p. 23, 1980 loc 4546

~~dist end femur during loc 4546 Musp. p. 23, 1980 white sheet~~

See white sheet also

1231

See also Kuebler (Hatch) & No. Am. Indian

~~San Luis Rey Valley south of Occidental Indian just
contacted by white man 1540 AD - + new record of 1880 a
found at mouth of San Luis Rey river (see Montoya 1952)
Collected by San Luis Rey 1542
San Luis Indian migrated from Great Basin area
(Cajon Pass?, San Geronimo Pass? - Taurus range)
of San Luis Indian Taurus range (San Geronimo)
from "Taurus" a page from the Hilde
of the San Luis Indian by BE Ma Green
Guthrie, Bureau of Geol. Surv. of Calif. 1953
58 pp. Taurus Plateau & above~~

Localities 4545, 4546, 4547 and 4464
Upper Oso Dam Basinian Maceus "Pocanga Lematai"
Orange Co.

4545 Loc. 1979 entered in catalog
above cobbles ~~zone~~ Barnes loc.
Stratigraphic loc. includes all of the massive, yellowish brown
sand that underlies the gray siltstone (Maffei's Point, Tm r
Monteury fm) and overlies the cobbles horizon (LACM 4546) in the
remnant of marine sediment left on the east side of the lake behind Upper Oso
Dam after the gradient. The site was formerly a lake.

Collected: *Cetacean*, *Otarionidae*, *Chondrichthyes* Dec 12, 1979

4546 Cobble horizon. Barnes loc 1870

Stratigraphic locality consisting of a [] thick layer of
brown sand containing numerous pebbles, boulders, concretions, &
fossil vertebrate & plant remains, lying about mid-section in the
remnant of marine sediment consisting of yellow to brown sands
on the east side of the lake behind Upper Oso Dam. This interval is
overlain by massive sand (LACM loc 4545) & underlain by similar
massive sand (loc 4547), neither of which have particularly numerous pebbles.

✓ Collected: *Chondrichthyes*, *Osteichthyes*, *Reptilia*, *Aves*, *Mammalia*. Dec 17, 1979

4547. Below cobbles horizon. This is a stratigraphic locality, later loc. 4545 & 4546
restricted to the interval of remnant yellow to brown sands on the east side
of the lake behind Upper Oso Dam left after gradient. This locality includes only
the massive yellowish sand below the pebble-bearing horizon LACM 4546,
and grades downward into a distinctly, white coarse sandstone, loc 4548

No list of materials collected. Dec 17, 1979

[Note: 1985 H. The covered of
Tolookes is from this station
also above. Small red muller
and Diomedea also seen
later]

Loc 4464 = Specimens found loose on upper

yellow-brown sand at top of sandstone horizon west side of dam

Rodney Rorcher loc. 368 1978

1 Township SE 44, Sec. 8, T6S, R7W Santiago Peak 7.5 S. Calif. "

These localities are
remnants of marine sediments
left behind the lake behind
Upper Oso Dam. The site was formerly
a lake. Orange Co.

Moulton Parkway - matters etc. Will meet at when far is.
Aliso Creek sites

Reef - 6 miles long

NS

"Reef" runs from

Wood Canyon SW of Ziggurat, to El Toro

up to train tracks. Earlier than Lurian

Reef is in San Onofre Breccia. Orange sand
grades up to Monterey shale.

Base Stadium say - March 13, 1958

March 12 '85 Loc 4547 R. Raschke 535

✓ Merc. shel. of Sulid Oso Dam

Aug. 9, 1981

right side
Distal radius right? left side? 1 change Lim.
Prox humerus rt ~~left~~? plaque brown sand
below gravel
ant end lower mandible in 3 pieces together br. m. tips 7 mm
Days of inc. of opposite humerus inc eroded dist end left in 3
at least 105.5 mm long. not long together
Prox radius overlies left Carpometacarpus (length complete)
Distal half of ulna 72.8 mm long
12.8 dist, depth

Loc. 4546 unnumbered

✓ Dist end left humerus during goose Aug. 1981 1 cm field part
br. dist 19.4 mm shaft h. 8.1? bone mended
ext depth 18.5 (14.3) ext mat depth 9.9?
int depth 13.3 mm.

Strongly resembles Shachtott Hill 4956 left
123992

Br. dist 21.8
int depth 13.5
ext in complete
shaft 8.7 x 10.2

And. Shachtott Hill 4956 rt
123993

br. dist 22.5? broken
ext depth 7 (14.2 ext mat)
8.8 x 10.2 shaft

BUT ① prox most muscle papilla more proximally removed from
distal in Oso Dam Bone more intact on shaft
Distance from center of lower papilla to Oso
" " upper " 18.5
more centrally placed
high papilla in Shachtott Bone
6.9 - # 123992 11.9
7.0 " 123994 12.9
7.9 " 123993 (12.1)

② Right the intercondylar space is
apparently more deeply excavated
with Oso Dam Bone than proximal
This is due to erosion

③ ext edge bordering space above condyles postl is
more raised in Oso Dam bone

Note Chedylus
this area broad & shallow

Over

March 12, 1985 cont'd OSO Dam addition

4546 cont'd (unnumbered) Barrow 3190

Oct 2

④ ✓ Frag of wing bone of ?? Puffin?
dist ulna 6.5 br, 5.1 depth ext

on yellow sheet

Puffin prox radius 4.3 x 3.7

leg in complete prox. frag. of carpal bone (?)

Shaft 3.2 x 2.4

⑤ ✓ Frag of bird bone ? Puffin

must be part of Barrow 3196

Apr. 23, 1980

Dist ulna 7.3 br x 5.4 depth ext

Shaft tars. (diver?) 2.9 ^{depth} 4.5 (gets deeper proximally)

suggests distal probably shearwater ~~see~~

See Shearwater (Hill) tars. 123554 (42, -3162

assigned to ? mitchelli

3.3 x 4.4

and a 98476/3165 assigned also to ? mitchelli

3.2 x 4.4

br. 8.6 x 6.2 ^{ext} _{depth} Shaft tooth dist ulna 17504/6688 Puffin sp?

CF. Complete Puffin ulna from Shearwater/Hill ? mitchelli
unnumbered 4956 5944

dist. br inc. dist depth ext 6.2 mm

prox br. 7.6, prox depth 9.0 length of bone 88.0 to olecranon

(Joan Brown coll. 23 Apr. 1980)

⑥ ✓ Shaft of ulna near prox end OSO Dam

Depth below prox end 5.2

on yellow sheet

Shaft tooth Hill 53

Dist below prox end in unnumbered complete ulna from Barrow 4956 5944

(see above also) assigned to P. mitchelli?

unnumbered

Loc. 1 Rold Raschke 431

Nearly complete humerus

Puffin

on yellow sheet

Prox br. 15.5 length to top of depression 82.7

br x depth shaft above dist end (m. middle)

3.8 x 7.1 (more compressed than mitchelli)

mitchelli 1625 42 x 6.4

length as above 86.3

mitchelli cast of hole 4.0 x 6.6

Length 924
73.9 smaller than RR431
3.4 x 5.7

of Shearwater Hill

OVER

Proximally internal margin below head more rounded than in mitchelli or pusio and Capital shaft ridge more acute. In these characters resembles Shearwater. Kiblaw 914 coll Dec 26-27, 1973 unnumbered but is larger than 914.

	Humerus	Ulna ^{9.5} with cotyle	ulna/hum ratio
P. guthriei	83.3 84.4	76.8 73.2	flat 91.0 86.0
gusui	108.5 108.8	102.0 96.8	flat 93 88+
creators 1978	114.8 114.2	111.9 107.4	round 97 94
pacificus	102.7 100.7	104.8 101.1	round 109.0 105.4
teniuschus	97.9 98.0	92.6 88.4	flat 94 80 90.0

Oso #120416 81.0 81.5 75.7? min. 792.8 83.9
 A Oso Dam #120420 95.7 q. 89.2 (cot)
 B Shalbach #124359 88.2 q. 83.0 cot

Mitchell 1 Shalbach #124359 98.1 A 97.5 q. 90.9 cot
 17 500mm 2 " prisms 446.58 in 1625 80.9 B 89.9 q. 84.5 cot
 3 Oso prisms 120416-81.3 77.8 74.8 71.8 68.8 65.8 62.8 59.8 56.8 53.8 50.8 47.8 44.8 41.8 38.8 35.8 32.8 29.8 26.8 23.8 20.8 17.8 14.8 11.8 8.8 5.8 2.8 0.8
 4 Oso prisms 120416-81.3 77.8 74.8 71.8 68.8 65.8 62.8 59.8 56.8 53.8 50.8 47.8 44.8 41.8 38.8 35.8 32.8 29.8 26.8 23.8 20.8 17.8 14.8 11.8 8.8 5.8 2.8 0.8
 5 Oso prisms 120416-81.3 77.8 74.8 71.8 68.8 65.8 62.8 59.8 56.8 53.8 50.8 47.8 44.8 41.8 38.8 35.8 32.8 29.8 26.8 23.8 20.8 17.8 14.8 11.8 8.8 5.8 2.8 0.8
 6 Shalbach #124359 88.2 q. 83.0 cot

when C Oso Dam 124360 32x4.7 what
 possibly same as 124359 what
 is complete

Shalbach #122994 6.3/6.7 Oso 120426 6.0/6.4 120425 6.4/6.9

Ulna 120416 with prisms humeri
 her longer ext. cotyle + more pointed +
 otherwise than Sh. 124359 + 124360 (adult 3/4)

9.5 dith P. guthriei 8.5 cr 102 tuba prox below cotyle (palmar)
 dith 8.5 rps 79.6 cr 92.5 broad space, depressed only immediately under the cotyle
 P. guthriei 8.5 cr 92.5 broad but somewhat more depressed
 P. guthriei 8.5 cr 92.5 narrower & deeper below cotyle
 P. guthriei 8.5 cr 92.5 broad & shallower below cotyle

9.1 dith 7.6 cr. prox Shalbach 124359 88.2 q. 83.0 cot
 broad - slightly depressed suggestive of gusui but smaller

dith 8.1 / 7.3 rps Oso 120416 81.0 81.5 75.7? min. 792.8 83.9
 Oso 120421 81.0 81.5 75.7? min. 792.8 83.9
 narrow below cotyle as in guthriei = prisms?

114.2 / 111.5
 102.78
 89.2
 79.4
 92.6
 91.3

over

Ulna

- Oso ✓ Ulna 120416 prox end + $\frac{3}{4}$ of shaft (area with humeri 2P, process)
 much more slender than 120420 has narrow deep area below cotyle and high anconal projection 7.2 x 7.6 prox br/depth
- Oso ✓ Ulna 120424 prox end (much less crista spinae bone) Similar to 120416
 has narrow deep area below cotyle and high anconal projection 6.5 x 8.0 br/depth prox
 correct to area with process humeri as against the one almost prox
- Oso ✓ Ulna 120421 prox end + separate dist. part area below cotyle like H 120416 above
 has narrow deep area below cotyle anconal projection not clearly defined (crack below tip) (which passes with humeri process)
 6.7 x 8.1 br x depth prox end
 7.5 x 5.7 br x depth dist end condyles only 4.3
- Oso ✓ ^{complete} Ulna 120420 is incomplete proximally but is notably larger than the three listed above (depth 8.7?)
 length 93.7 br/depth dist. 8.5 x 6.5 condyles only 5.0
- Oso ✓ Dist ulna uncat. 7.5 x 5.7 br depth dist condyles only 5.0?
 cruris
- Sh T 4956 uncat. broad below cotyle 7.6 x 9.5 prox br/depth
 depth dist 6.2 (4 mm) length 88.2
 br condyles only 4.7 Not long enough like mitchelli?
 unless ulna in mitchelli is shorter (relatively than in process). Note the ulna in Oso # 120420 is more likely for size for mitchelli
- Sh T 122943 prox 7.8 x 9.1 br depth prox
 broad below cotyle, prox projection round, depressed + mitchelli? shaft below also depressed Suggests Oso 120420
- Sh T Dist end 18697 8.3 x 6.4 br/depth
 br condyles only 4.5
- Sh T 17204 dist 8.3 x 6.3 br/depth, condyles only 4.8+
- Sh T 11771.9 dist 7.4 x 5.3 br/depth dist condyles only 4.2
 " " "

Size variation in *Sula leucogaster leucogaster* (= specimens) ^{avg 15.3mm}

min	max	crania	per	humeri	max	dist	ulna	max	in dist	carp.
1349	76.2	77.5 (ml.)	10.4	147.4	20.5	16.8	11.3	11.3	10.5	8.6 70.4
1352	51.9	52.8	13.2	166.6	23.5	19.5	179.0	13.2	12.2	10.8 77.6
251	50.3	54.3	11.7	162.7	23.4	18.5	181.0	12.7	12.0	9.8 79.0

leucogaster
leucogaster to h. hum. 1349 50% to dist hum. 61%
 max 1352 56% 67%
 251 50% 69%
 17498 h. 14.3 }
 to type humer 18.5 } 26%

147.4) 142.7
 147.4
 15.36
 147.4
 560.0
 Cera, 120428 11.6 64%
 to type humer 18.5
 of vagabond

S. Hill for 6688 prox hum 50418 h. 22.35 to ext 23.1 to prox h.
 shaft 8.4 x 7.0
 H 120433 (4546) wic h. 22.3 - sh. 10.0 x 8.2 length 182.3?

S. Hill for 6688 H 17496 length 162.20
 98.8
 634
 162.2
 101.3
 81.2
 182.5 120433 length 182.3 humerus

64
 185) 11.60
 11 10
 500

120433 ulna length 159.1, prox h. 14.2

185) 1430
 10 1295
 225 11250

max to min
 max br. in Sula
 leucogaster
 23.5) 26.50
 1880
 1.700
 1645
 550

length deltoide
 40) 350
 320
 300
 300
 200

h. crania
 032 180-
 14.7) 116.70
 17.76
 13.2) 104.6
 924
 max
 min
 length 1160
 1128

max 187.5
 186.7) 163.40
 050 14936
 14040
 13069
 9910

humerus length

humerus length
 max/min
 leucogaster
 1666) 14240
 13328
 14120
 13328
 7920

List of specimens by family - ^{order} locs 4545, 4546, 4547 ^{and} 4464 5

Procellariiformes

Puffinus

- 4464 P. sp. dist radius 120412 (loc 4464)
- P. pusillus? humus 120413 (loc 4546)
- " ? assoc'd 2 humeri, 1 ulna 120414 (loc 4546)
- " ? dist end of humerus 120417 (" ")
- " ? at carpalometacarpals 120418 (" ")
- Puffinus sp. + anomalous 120419 (" ")
- Puffinus sp. at ulna (very long) 120420 (" ")
- Puffinus sp. at ulna (w/ 3 ptes) 120421 (" ")
- ? Puffinus inceptor? assoc. humerus, radius, ulna 120422 (loc 4546)
- Puffinus sp. radius (length 67.7mm) 120423 (" ")
- Puffinus sp. 120424 (" ")
- Puffinus sp. prox end ulna 120425 (" ")
- Puffinus sp. dist end + distans 120426 (" ")
- " " " " " " " " " " " "

Diomedea

- 4547 Diomedea sp. assoc. w/ ^{length at least 180mm} radius + ulna 120439 (loc. 4547)
- (3 ptes) (prox 1/2)

Pelecaniformes

Sulidae

- Morus? cranium + 120427 loc. 4546
- Sula willetti? assoc. ^{frag} prox humerus + coracoid 120428 (loc 4546)
- Sula willetti? nearly comp. at tarsus 120432 (" ")
- Sulidae prox radius 120429 (" ")
- Morus vagabundus?? prox humerus 120430 (" ")
- " " ?? dist " 120431 (" ")
- " " (61.21.0) 120433 (loc 4546)
- " " ? assoc. 2 humeri + ulna + radius 120438 (loc 4547)
- Poorly preserved

- 4547 Sulidae sp. assoc. dist frag. ulna + radius 120438 (loc 4547)

Charadriiformes

Alcidae

- Alcedo ulmulus? left ulna 120434 (loc. 4546)
- " " w/ humerus 120414 (loc. 4545)
- " " w/ coracoid 121010 (loc. 4547)
- " " " " " "

unidentified → Omer

may contain fm.
Puff. m. longirostris
@ Wehm = 21.1

loc 4545 + 4546

Unidentified

4545 very incomplete cranial area of skull (?) 120413 loc 4545
proximal crushed left tibia tarsus 120437 loc 4546
Very incomplete distal frag + shaft of femur 120436 loc 4546
120435 loc 4546
Very crushed humerus (?)

Totals 23 from 4546

2 " 4545

3 " 4547

1 " 4464

29 Bones total

Nov 15 SIP meeting

with # required
names

Three must be present in a group, in addition to the

Presidents 72 A (see # 72)

1964

Outstanding call of 2nd Anniversary

Locality 4546

Ulna referred to ? Alcodes ? ulnulus no 126434
described from locality Loc 1945
Holotype ulna Loc 18277

Note: As described the holotype ulna has a distal
crest to *Actinia pusilla* but is much stouter
ext length 27.6 (A. pusilla & holotype Alcodes ulnulus
prox br 5.7 (holotype Alcodes) 3.7 Actinia pusilla
br/depth sh 2.9/4.9 " ") 1.7 12.5 " "
ext distal end 5.3 " ") 3.4 A. pusilla

Loc 1945/18279
ulna distinct
ext depth 5.7
br/depth sh 2.8/4.0

Loc 4546 ~~1945~~ case 120434 is worn (cracked)
Holotype Alcodes ulnulus
ext length 29.0 to edge of condyle
prox br 5.7 complete
ext depth dist end 5.4
br/depth sh 2.9/4.9
Loc 1945
19280

Locality 4545
A. ulnulus from 1945 ulna 18279 sh. 28/4.22
ext depth dist end 5.6
prox br 5.6 +
br/depth sh 3.3 x 4.9
Loc 1945
19280
Loc 4545
Humeral at Loc 120414 probably same sp. as
18277 from loc. 1945 = holotype ulna of Alcodes ulnulus

Has the flattened shaft characteristic of *H. ...* as in *Mauicalla*
transverse axis, and the high ectepicondylar
processes flattened against the shaft.
Has a sharper crest-like ridge, internal
the pectoral attachment suggest that it
bordered the pneumatic fossa of which does
not show on the specimen - pupil's incomplete

The incomplete specimen measures 55.4 mm
(it could be as much as 57.5-58)

The shortest *Mauicalla* (M. milleri) is 56.4
The shaft is narrower and
less deep than in *Mauicalla*
br/depth sh 2.7/4.7/1 (Mauicalla is 2.5/5.0)
Below the deltoid are 2.5/5.0

M. milleri paratype
Loc 1071/2813 length 58.06
condyles, humerus br 3.5
deltoid (delt 82
below deltoid 3.3, 6.8
least meas of shaft

Below the deltoid are 2.5/5.0
There is a suggestion that the deltoid crest is lower
than in *Mauicalla* - extending below the level of
the Bicipital crest.

Loc. 4547

Coelocis # 121010 has ^{relatively} long, slender proportions found in the Mammalia

length from scap. facet to head ^a 11.9 or below furcula facet ^a 3.5
length from scap. facet to sternal facet ^b 24.8 or sternum ^d 12.0

Same dimensions in *Ceolobunia* ^a 11.7 ^b 25.7 ^c 4.1 ^d 10.1

" " *Unio* ^a 15.0 ^b 26.9 ^c 4.3 ^d 14.6

" " *M. mellei* ^a 13.0 ^b 30.5 ^c 4.1 ^d 15.4

	121010	<i>Ceolobunia</i>	<i>Unio</i>	<i>M. mellei</i>
length from scap. facet to head	11.9	11.7	15.0	13.0
length from " " to sternal end	24.8	25.7	26.9	30.5
breadth below furcular facet	3.5	4.1	4.3	4.1
breadth sternal end	12.0	10.1	14.6	15.4

Loc 4442
117747
M. mueleri
Spain

Alcedo ulmulus ulma

	Loc 4546 # 120434	140104 1945/18272	Referred dist 1945/18274	referred puy 18280
23.3 Length to ext cotyla	29.7	29.0	—	5.6 +
5.2 Br prox cotyla	5.1 (inc)	5.7	—	7.8 + inc
8.0 depth prox end (ext)	7.9 + (inc)	8.5	—	—
6.4 depth dist end (ext)	5.3 v	5.4 v	5.6	—
7.3 Br dist end Gr	6.1 (inc)	6.0	6.1	—
4.9 Br dist trochlea only	3.7 v	3.9 v	3.9	3.2
3.3 Br sh (middle)	2.9 v	2.9 v	3.0	4.7
5.4 depth sh (middle)	4.5	4.9	4.1	—

Coracoid probably *A. ulmulus* loc 4547 / 121010
 4442 117747 19380
 small m. mueleri m. mueleri
 cyllus columba guellinot 1173

Length	34.1	38.0	37.4	33.0
Br bln face	3.6	4.0	4.0	3.7
Br sh below facet	3.1	3.7	3.3	3.3
Depth same place	4.4	4.2	—	?
Dist Scale facet to prox end	11.6	13.4	12.7	12.7
Br ^{across} facile facet	6.4	6.0 inc	6.2	7.4
Depth dist end	3.8	3.4	5.4	4.3

Though the distal facet is slightly deeper than in *M. mueleri* it lacks the notable depth found in the flycatcher such as *Guellinot* (*Cephus*) *Mimus* *Unia* *auk* (*Circus*)

The coracoid is believed to be of the same sp as the ulna & humerus and related to the ^{furcula} mancolline *auks* based on the flatter shaft & narrower distal ~~facet~~ ^{sternal} facet.

The holotype of *Alcedo ulmus* is a complete
#18277 from loc 1945. *Ulm* #120434 from ^{loc 4546 upper} GSO Dam
resembles this *ulm* in general configuration - short and stout
and with a small blunt carpal tuberosity ^{Due to poor preservation papillae are}
difficult to see, but more apparent on the
and with a line of small depressions on the ext. surf
of the shaft. Due to the poor preservation of the bone
neither the raised areas nor the depressions are as clear
as in the holotype.

The papillae are difficult to distinguish
but probably there are 9.

The cracoi from loc 4547 has the skin
lives found in the *Mauacalla* with a small facet a
narrow ^{oval} rather than lacking the ant. process found in the
typical *alced*. The length 33.9 is less than the mean
rounded for *M. nelleri* (38.8) (meas. in same place as his
at 37.8).
The scapular facet is more round than one.
Tho the specimen lacks the extension (coracoid process?)
and is incomplete laterally it appears to be a slightly
~~thicker~~ less flattened than *M. nelleri* + ~~the~~ with border
does not ^{eventually} have the straight shape of *Mauacalla* with narrow sternal facet
as compared with typical *alced*; Possibly even stouter
than *Mauacalla*. Ext. contour incomplete, int. doesn't flare.

Fossil Birds of the San Diego
Formation, Lake Plumer, Blanca,
San Diego County, California

Robert H. Chandler

Abstract of Thesis 1985

Morus Uagabunda

Loc 4088 - complete humerus 17496
ulna shaft
carpals.

prox left hum 50618
dist " 50618?
prox humus no #

loc 1625 - prox hum 17432 + 16471
dist 13980, 16467
ulna prox 16470, 72, 23

P. incertum? prox hum 16972 loc 1537

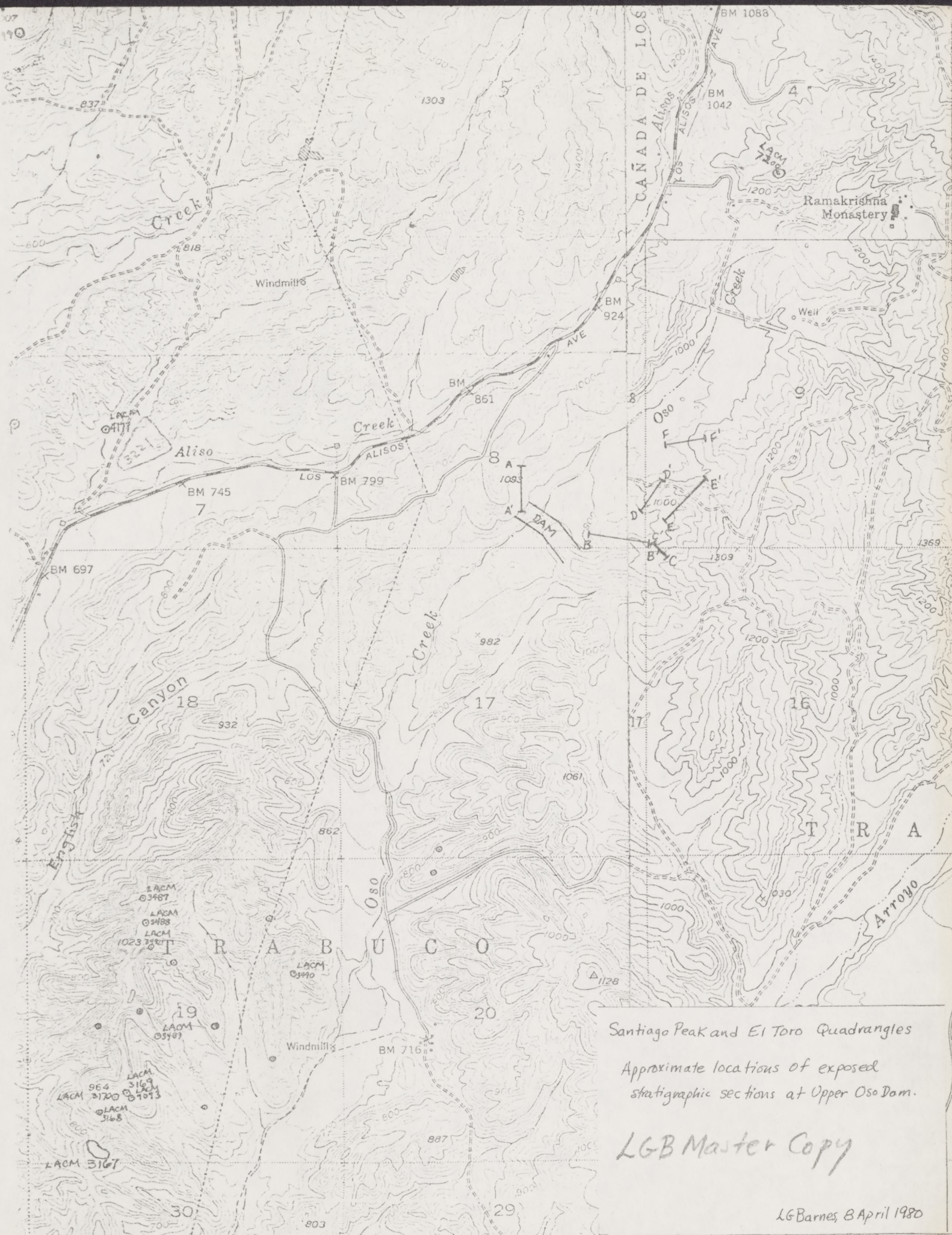
Joseph F. Arndt

~~Arndt~~

18012 So. Martha Place

Cerritos, Calif, 90701

phone 926-1231

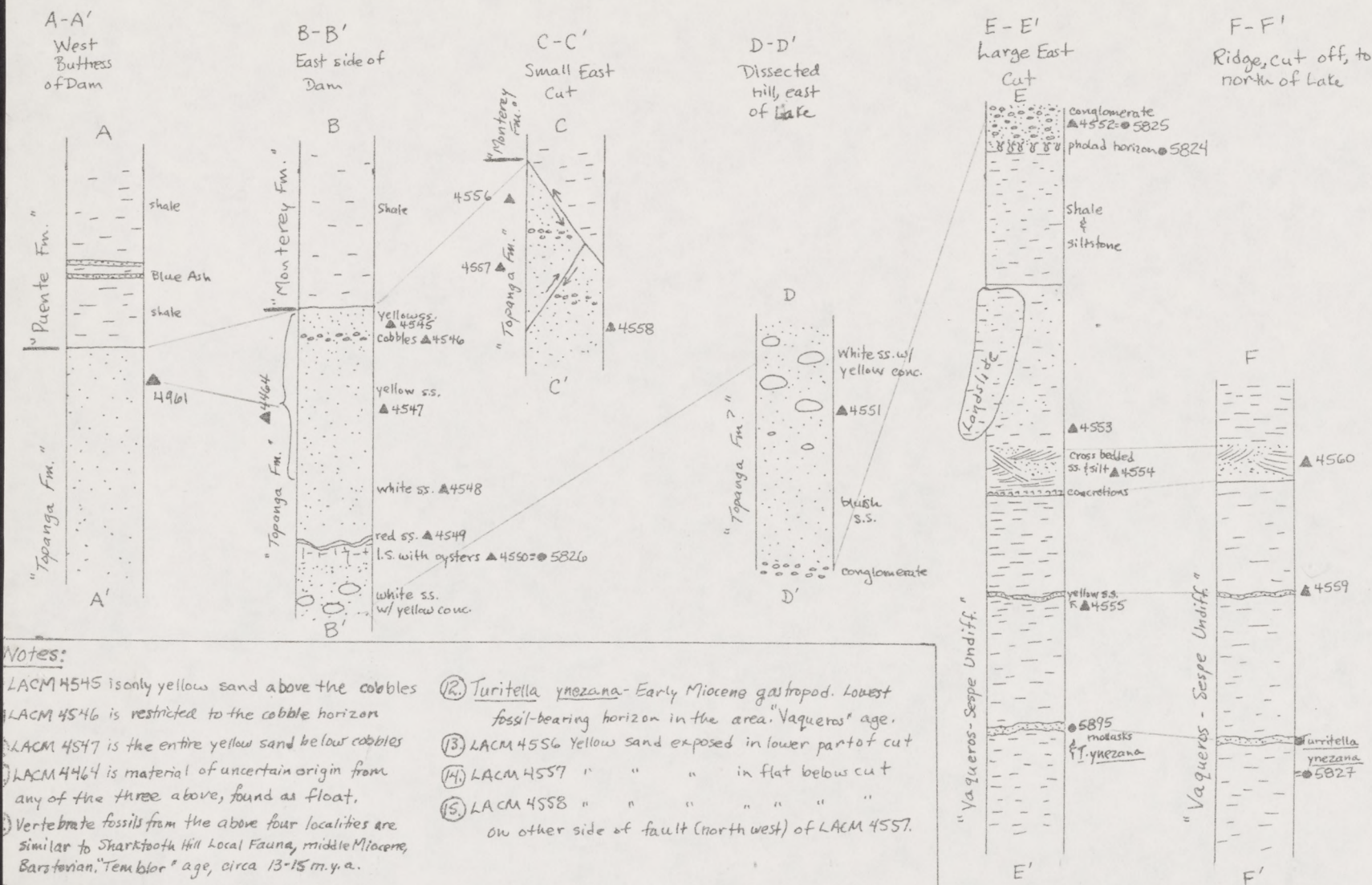


Santiago Peak and El Toro Quadrangles

Approximate locations of exposed
stratigraphic sections at Upper Oso Dam.

LGB Master Copy

LGBarnes 8 April 1980



Notes:

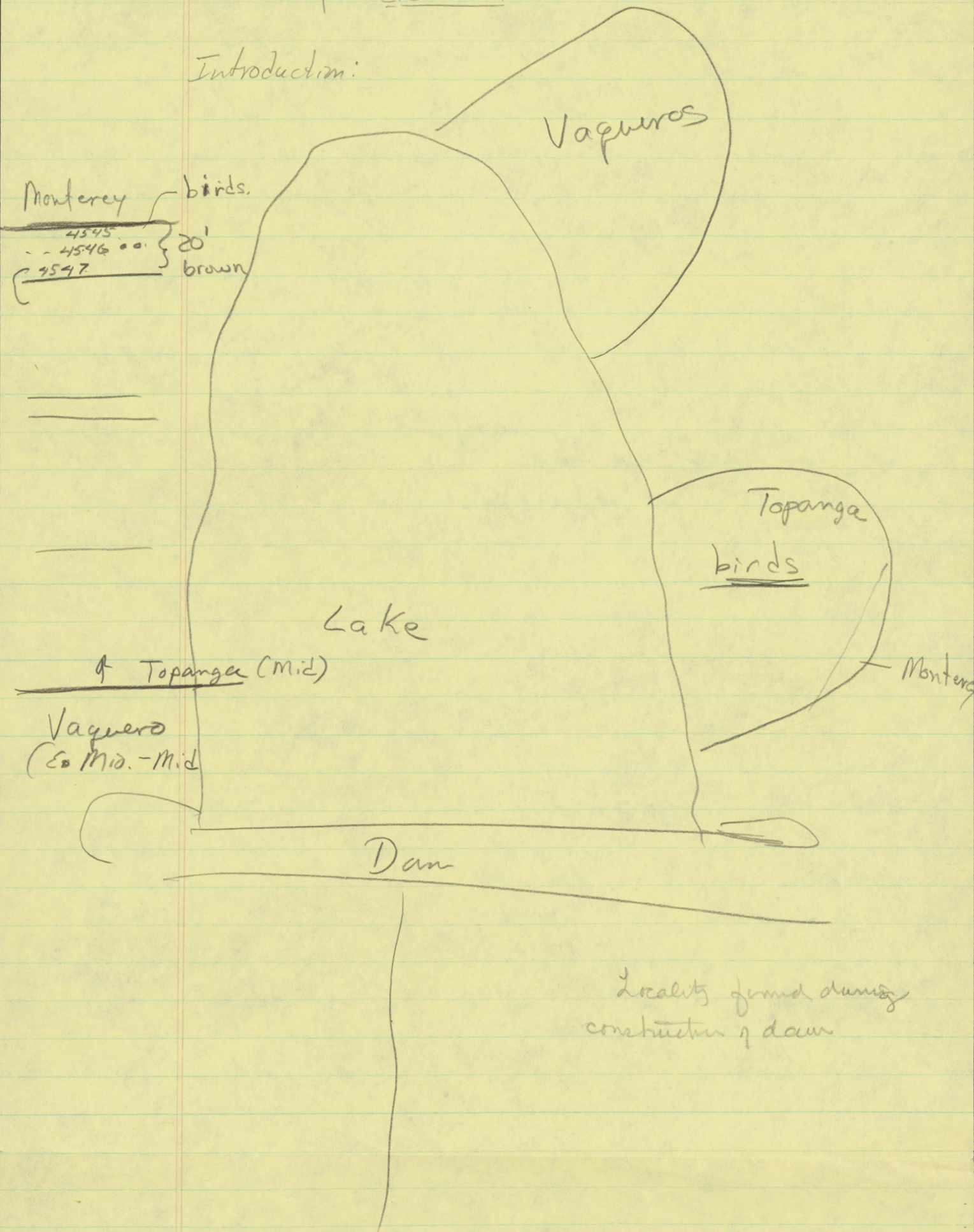
- LACM 4545 is only yellow sand above the cobbles
- LACM 4546 is restricted to the cobble horizon
- LACM 4547 is the entire yellow sand below cobbles
- LACM 4464 is material of uncertain origin from any of the three above, found as float.
- Vertebrate fossils from the above four localities are similar to Sharktooth Hill Local Fauna, middle Miocene, Barstovian, "Tombler" age, circa 13-15 m.y.a.
- LACM 4550, a predominately tropical assemblage, limestone, oysters, parrot fish, trigger fish, dugongs, pelagic sharks, rays, etc.
- LACM 4551 - Dugongs.
- LACM 4552 - Dugongs (oldest in Calif.), sharks, horse.
- LACM 4553 - Artiodactyl in marine(?) siltstone
- LACM 4554 - Totally terrestrial assemblage. Rodents, rabbits, camels, tortoise, turtle, hedge hogs, etc. Early middle Miocene, Hemingfordian, early "Tombler" circa 15-18 m.y.a. also LACM 4560.
- LACM 4559 Small early-middle Miocene sharks
- (12) *Turritella ynezana* - Early Miocene gastropod. Lowest fossil-bearing horizon in the area "Vaqueros" age.
- (13) LACM 4556 Yellow sand exposed in lower part of cut
- (14) LACM 4557 " " " in flat below cut
- (15) LACM 4558 " " " " " " " " on other side of fault (north west) of LACM 4557.

Annalisa ~~Berta~~ Berta
619-265-5387

Xerox Ray Downing +
Barnes.

variability to I. downsi.

Introduction:



COPY

Unpublished

Mailed orig. to Larry Dec 17 1981

①a

Identifications of bird bones from Upper Oso Dam localities
LACM 4464 (1), 4545 (2), 4546 (23), 4547 (3). *Hiedyude Hamed*

Note: Crushing in many cases makes definite identification impossible.

Procellariiformes

2(21) Family Diomedidae -- Albatrosses

Diomedea sp. -- LACM no. 120439, loc. LACM 4547

Associated proximal end of ulna and distal end and shaft fragments of radius. Possibly D. milleri, though slightly larger. Two species of Diomedea are described from Shark-tooth Hill (D. californiensis, which is large, and D. milleri, small).

16 Family Procellariidae -- Shearwaters. All with one exception (see below) from loc. 4546.

cf Puffinus priscus Milner --

Nearly complete humerus LACM no. 120415 ✓

Associated left and right humeri and right ulna no. 120416 ✓

Distal end of right humerus no. 120417 ✓

NOTE: the humeri all tie in either with the holotype (distal end) or referred complete specimens of P. priscus from its type locality, Sharktooth Hill

cf Puffinus inceptor Wetmore (holotype a distal end of humerus from Sharktooth Hill)

Right nearly complete (but crushed) humerus no. 120422, ✓
(and associated proximal end of ulna (very crushed) and proximal and distal ends of radius.

NOTE: humerus resembles complete humerus from Sharktooth Hill (Arndt DI4) referred (HH) to P. inceptor.

Puffinus sp.

Right carpometacarpus no. 120418 ✓

Right tarsometatarsus no. 120419 ✓

Proximal and distal fragments of radius 120423 ✓
and 120412 (loc. 4464)

Proximal fragment of left ulna no. 120424 ✓

Two distal ends of tibiotarsi nos. 120425 and 120426 ✓

Complete right ulna no. 120420 ✓

Fragment of right ulna no. 120421 ✓

Pelecaniformes

14(8) Family Sulidae -- Boobies and Gannets

?Sula willetti Miller from locality LACM 4546

Associated coracoid and proximal fragment of humerus shaft, no. 120428

NOTE: The coracoid fits the impression of this element in UCLA specimen 2839 from Lompoc (at hand) referred to S. willetti by Miller (1925, pl. 8). It is more slender than any sulid coracoids from Sharktooth Hill

Tarsometatarsus no. 120432 lacking part of proximal end (estimated length 44.6 mm) Length of tarsometatarsus in UCLA 2839 (see above) is also 44.6 mm. The holotype specimen of S. willetti has tarsometatarsus of 41.0 mm in length.

?Sula willetti Miller from LACM loc. 4547

Associated incomplete radius and ulna no. 120438

NOTE: cannot be compared with Lompoc material, but small size suggests same species as noted above (in locality 4546. The shape of the radius is more like modern species of Sula than of Morus.

Over Sulidae continued

Sulidae sp.?

Uncatalogued Assoc. skeletal elements from loc 4547

Collected Aug 9, 1981,

Includes { on left side of plaque
7 bones } Dist. radius
across } prox humerus rt.
ant. end lower mandible in 3 pieces

{ on right side of plaque
x 3 fragments of left humerus estimated to
equale 165.5 mm in length (with incomplete
eroded distal end)
+ x prox. radius overlies a left carpometacarpus
(carpo. length complete 72.8 mm
dist end depth 12.8 mm
x Dist. half of ulna

Anseriformes

genus + sp.?

don't force

uncatalogued left femur (dist)

18 May 21, '85

same Puffinus 24 bones

Procellariidae ~~xxxxxxxx~~ -- Shearwaters Loc. 4464 encompasses all locs.

Puffinus priscus

482 mm

Loc. 4546 no. 120416: Associated left and right humeri and right ulna (total 3 bones)

Loc. 4546 no. 120415: Nearly complete humerus ~~xxxxx20x15~~ 1 bone

Loc. 4546 no. 120417, distal end of righthumerus 1 bone

Loc. ? uncatalogued Prox. end (3/4) humerus (R. Raschke (400) 19 Sept. 78

Puffinus sp. (does not agree with P. priscus) Two sets same sps?

Uncatalogued R. Rasche 431 1981? loc. ? (longer than sharktooth Hill

humerus Kirkland DI4 (1973) which is thought to be inceptor.

Loc. 4546 no. 120422: associated humerus (rt), prox. ulna (very

crushed) and proximal and distal ends of radius. (3 bones)

This humerus also longer than the SHARKTOOTH Hill Kirkland

bones thought to be inceptor ~~XXXXXXXXXXXX~~

Puffinus sp.

✓ Loc. 4546 no. 120418, rteacarpometacarpus

✓ " " no. 120419 right tarsometatarsus

✓ " ~~xxxx~~ no. 120423, prox and dist frags radius

✓ " no. 120412

✓ " 4546 no. 120434 prox frag. left ulna

✓ " nos. 120425 and 120426 two dist. ends tibiotarsi

✓ " 4546 no. 120420 complete right ulna

✓ " no. 120421 frag right ulna

✓ " 4546 uncatalogued prox. inc. ulna Joan Brown coll. Apr. 23, 1980

Genus? 4547 uncatalogued distal tibiotarsus Barnes 1876 (Raschke coll.)

✓ 4546 uncatalogued frag. tarsus, ulna Mus. Party 23 Apr. 1980

Loc. 4546 uncatalogued frag. ulna and radius Barnes 3190

✓ Loc. ? uncatalogued dist. 3/4 left ulna Barnes 1976

✓ Loc. 4546 uncatalogued prox radius, prox. carpometa Barnes 3190

Puffinus sps.

-1 Loc. 4546 no. 120434 prox. frag. left ulna

-1 " " no. 120420 complete right ulna

-1 " " no. 120421 frag. right ulna

-1 " " uncatalogued inc. (prox) ulna Joan Brown coll. Apr. 23, 1980

-1 " ? uncatalogued 3/4 dist. left ulna Barnes 1976

-1 " 4546 no. 120423 prox ~~xxxxx~~ frags. radius ~~xxxxx120x12x#6xxx~~

-1 " 4464 no. 120412 dist. frag. radius

-3 " 4546 uncatalogued prox radius and prox carpometa Barnes 3190

-2 " 4546 nos. 120425 and 120426, two dist. ends tibiotarsi

-1 " 4546 no. 120419 right tarsometatarsus 2 P. priscus based on size of SHARKTOOTH

-1 " 4546 no. 120418 right carpometacarpus

-2 " 4546 uncatalogued frags. prox. tarsus, dist. ulna Mus party

Procellariidae??? loc. 4547 uncatalogued dist tibiotarsus Barnes 1876

Rascheke coll. 1, 11, 79

108
144 115 220 224
144 220
1206 940
1153 260

only one Puffinus from ASD - It is smaller than the two most complete from Sharktooth C. 45476 (12255 Y) and same size as smaller sharktooth previously specimens 104058

Note Sharktooth complete humerus 18140 assigned to P. priscus length 82.5, prox. 15.1 dist. br. condyles 7.3 (holotype P. priscus dist. br. cond. 7.3 also.

Family Sulidae continued

5(91) Morus sp. from locality LACM 4546

Associated humeri, ulna, radius (5 bones) badly crushed)

no. 120433 Warheit

NOTE: Referred to genus Morus on the basis of humerus longer than ulna. Bones are larger than specimens from Sharktooth Hill referred to Morus vagabundus Wetmore not only in length but in shaft breadth. However, more study of the Sharktooth Hill material is desirable.

NOTE no. 2: The humeri are much larger than those referred above to ?Sula willetti (120428) Warheit (see previous page)

Add ① 4 Sulidae genus and sp. ? -- all from locality 4546

Skull fragment no. 120427 Warheit

Proximal end of radius no. 120429

Proximal end of humerus no. 12030 Warheit

Distal end of humerus 12031 Warheit

→ still here

Order Charadriiformes -- Shorebirds

Family Alcidae -- Auks, Murres and Puffins

Subfamily Mancallinae -- flightless auklike birds

?Alcodea ulnulus Howard -- described from LACM loc. 1945

Ulna no. 120434 from locality 4546

NOTE: The holotype of Alcodea ulnulus is an ulna which is slightly shorter and stouter than no. 120434 but no. 120434 is worn.

Humerus no. 120414 from locality 4545

Has the flattened shaft characteristic of the Mancalline auks and the high ectepicondylar process flattened against the shaft. Is markedly smaller than any specimen referable to Mancalla.

Coracoid no. 121010 from locality 4547

Has the relatively long, slender proportions found in Mancalla, but is smaller than any specimen of that genus

AVES undetermined

Skull fragment no. 120413 from locality 4545 Not bird?

Crushed humerus no. 120435 from locality 4546 ?

Distal end of femur no. 120436 from locality 4546

Crushed ?tibiotarsus no. 120437 from locality 4546

Diving Goose distal left femur mms. field path Aug 1981

Add Sulidae sp. loc. 4547 Raschke 535 August 9, 1981

20m ss below grave

- uncat. - Associated

7 (of 15)

above set { fragments of lower jaw (acids + anterior fusion (tip looks complete))
 { prox humerus left
 { distal radius right
 { prox and distal ends of humerus right
 { Left Carpometacarpus overlain by these lie between the two halves of the humerus
 { prox radius
 { distal 3/4 + ulna left

Add Anseriformes (?)

- uncat. distal left femur loc 4546 mms field path Aug 1981

Typed

Uncataloged Puffins

- ✓ 1 humerus right RR431 date loc? nearly complete n. sp?
- ✓ 1 humerus right prox $\frac{3}{14}$ RR400 19 Sept 1978 loc? r. sp?
- ✓ 1 ulna left dist $\frac{3}{4}$ + Bone 1974 loc?
- ✓ 3 ulna at dist, radius prox, inc prox. rt. Carbonate active
- ✓ 2 ulna left dist, shaft, tarsometatarsus (left) mus parts E3 April 1980
- ✓ 1 ulna prox left. from Bone 23, April 1980 45-46

12024 ulna right left Bone 3199 April 23, 1980

Dist tibiotarsus right 4547 RE 11, Jan. 1979 (Bone 1874)

Paracatalpa?

Puffinus sps.

Referred material. From locality LACM 4546; complete right ulna, LACM 120420; fragments of proximal and distal ends of right ulna, LACM 120421; distal 3/4 left ulna, LACM 124360; proximal end of left ulna, LACM 120424; fragment of proximal end of left ulna, LACM 120425; associated distal end of ulna and proximal fragments of radius and carpometacarpus, LACM 120423; complete radius, LACM 120423; right carpometacarpus, LACM 120418; distal ends of right and left tibiotarsi, LACM 120425 (right) and 120426 (left); associated fragments of tarsometatarsal shaft and distal end of left ulna, LACM 120412. Exact locality uncertain: distal fragment of radius, LACM 120412; nearly complete left humerus, LACM 120412.

Discussion. Size alone suggests that at least two species are represented in this material. Most of the specimens are of the small size suggestive of P. priscus. One humerus (LACM 120412) and one ulna (LACM 120420) are, however, notably larger. The humerus appears to have the flattened shaft toward the distal half of the bone as in specimens from Sharktooth Hill assigned to P. mitchelli. The length of the poorly preserved bone, from proximal edge of brachial impression to head, is 83.2 mm. The same measurement in Sharktooth Hill humerus LACM 17500 referred to P. mitchelli is 86.6 mm. Ulna LACM 120420 has a length of 95.7 mm. The longest ulna found at Sharktooth Hill (LACM 124359) measures only 88.2 mm. Both are markedly longer than the nearly complete Oso Dam ulna (LACM 120416) associated with the humerus of that same number which is assigned to P. priscus.

Specimens of small size -- check with Sula willetti

From Oso Dam

LACM locality 4546: associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432. From locality LACM 4547, associated incomplete radius and ulna, LACM 120438.

Coracoid 120428 fits into impression of this element in UCLA 2839 from Lompoc, which Miller referred to S. willetti (1925, pl.8) but did not discuss in text. Tarsometatarsus no. 120432 also agrees in general dimensions with UCLA 2839 tarsometatarsus (approximate length 44.6 mm). In the holotype skeleton, the tarsometatarsus was given (Miller 1925:114) as 41.0 mm. The associated radius and ulna from LACM locality 4547 cannot be compared with the Lompoc material. The small size of these incomplete specimens, however, suggests the same species as represented by the specimens from locality 4546. The shape of the radius resembles that of Sula rather than Morus.

From Sharktooth Hill

LACM locality 3499: associated complete humerus, proximal and distal ends of ulna, coracoid, LACM 98601. Humerus length 155.9 mm (length of humerus of S. willetti given as 156.0 mm (Miller, 1925:114)). This specimen is being sent to you, Ken. *dist. en. 16.8 vs 98601*

NOTE: The above material should be checked with specimens from LACM locality 1945 assigned to Microsula sp. (Howard 1968): humerus LACM 17556, *distal end of carpometacarpus* LACM 17555, proximal end of tarsometatarsus LACM 17554. Locality 1945, although said to be of the Monterey Formation, contained Desmostylus, and suggests an intermediate stage between that represented at Sharktooth Hill and typical Monterey. At LACM locality I find alcid bones assignable to Alcodes, heretofore recorded only from LACM 1945.

Other specimens of interest

From Oso Dam

LACM locality 4546: associated right and left humeri, ulnae and badly crushed radius, LACM 120433. The humerus is longer than the ulna, thus suggesting genus Morus. Length of humerus 184 mm, ulna 158.6 mm

From Sharktooth Hill

Other than the small humerus mentioned above (LACM 98601) I found only two other humeri on which I could obtain measurement of length-- LACM 7432 recorded (Howard 1966) length 170 mm; LACM 17496 (unrecorded) length 163.4 mm. Distal breadths could be taken on ten specimens giving greatest distal breadth 21.8 max., 16.2 min. Six are larger than the holotype of vagabundus (18.4-21.8); four are smaller (16.2-17.2. Thought should now be given to Morus loxostylus from the Miocene of Maryland (referred distal end of humerus, Wetmore 1926, distal breadth 21.1 mm) In my 1966 Sharktooth Hill paper I ruled out M. loxostylus because all the specimens then known from Sharktooth Hill were smaller than Wetmore's referred specimen. (See Howard, 1966, p. 6)

Morsula sp. from 1945 humerus 17556 dist end 15.3 mm

Sula fisheri breadth humerus dist

Morus

Sula sp. - from Sh Hill 98601 dist end 16.4 (condyles only 13.2) 13.0

Morus vag.

18.3 (" " 14.5

Dear Ken

27. It has been nearly a month since I received your letter of November. You brought up some points that I hoped to be able to comment on, but it took a couple of museum trips to do it.

First, regarding that associated skeleton with the carpometacarpus of 72.8 mm length. You asked what "conversion; I used to get the figure 166. That was a measurement of the bone itself. However, your comments prompted me to examine the specimen more fully, and I found that I could detect a faint outline in the matrix which suggests the proximal rounding of the bone. In that case, the length would be at least 177.4. However, the specimen is really too poorly preserved to base too much on measurement other than the complete carpometacarpus. I wish you could see the specimen, but it is such poor shape that I would be afraid to think of sending it, even if taken "by hand." Each time I get it out, ~~xxxxxxx~~ I note its fragility (even the carpometacarpus ~~xxxxxxx~~ is in need of repair now.

I have gone back over the notes I made before you decided to take on the "big job." ~~I have~~ I have copied some of these off for you and enclose them, herewith. I realize measurements ~~may not be exact.~~ ~~may not be exact.~~ I note that ~~recording of the same specimen at different times~~ can vary. ~~xxxxxx~~

I wish I had noted in what way radius 120438 from Oso resembled Sula rather than Morus. Evidently I intended to go into that with further study. ~~xxxxxx~~ Let me know what you think when you examine it.

I hope you get to see the humerus that Wetmore referred to Morus
loxostylus while at the Smithsonian. I asked Storrs to be sure to
show it to you. no. 8863

I am sure you have Wetmore's paper (1926) about the specimen. He gives some characters differentiating *Sula* and *Morus*.

Specimens of small size -- check with Sula willetti

From Oso Dam

LACM locality 4546: associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432. From LACM locality 4547: associated radius and ulna, LACM 120438. could be more

tarsus in Coracoid 120428 measures approximately 12.3 mm greatest breadth; fits into impression of this element in UCLA 2839 from Lompoc which Miller referred to S. willetti (Miller, 1925, pl. 8) but did not discuss in text. Length of UCLA 2839 approximately 44.6 mm. Holotype of S. willetti (UCMP 26542) given by Miller (1925:114) as 41.0 mm. *for tarsus*

The associated radius and ulna from LACM locality 4547 cannot be compared with the Lompoc material, but small size suggests same species as represented by specimens from 4546. The shape of the radius resembles that of Sula rather than Morus.

Sula willetti has not been recorded from either Sharktooth Hill or Sharktooth Hill locality LACM 1945

LACM locality 3499: associated complete humerus, proximal and distal ends of ulna, coracoid, LACM 98601. Humerus length 155.9 mm. (Length of humerus of S. willetti given by Miller, 1925 as 156.0 mm) Coracoid has greatest breadth of 13.0 mm. This specimen has not been recorded.

NOTE: The above material should be checked with specimens from LACM locality 1945 assigned to Microsula sp. (Howard 1968): Humerus LACM 17556, distal end of carpometacarpus LACM 17555; proximal end of tarsometatarsus LACM 17554. Locality 1945, though said to be of the Monterey Formation, contained Desmostylus, and suggests an intermediate stage between Sharktooth and typical Monterey. At Oso Dam I find specimens assignable to Alcodes which is heretofore recorded only from LACM 1945. (Alcodes is an alcid).

Specimens of large size

From Oso Dam

LACM locality 4546: associated right and left humeri, ulnae and badly crushed radius, LACM 120433. The humerus is longer than the ulna, thus suggesting genus Morus. Length of humerus 184 mm, ulna 158.6 mm (prox. breadth ulna 14.1 mm)

From Sharktooth Hill

Other than the small humerus mentioned above (LACM 98601) I found only two other humeri on which I could obtain measurement of length-- LACM 7432 recorded (Howard 1966) length 170 mm; LACM 17496 length 163.4 mm (unrecorded). Distal breadths could be taken on ten specimens (greatest distal breadth smallest 16.2, largest 21.8--type given 18.3) Six are larger than the type (18.45-21.8); four are smaller (16.2-17.2). Thought should now be given to Morus loxostylus (Miocene of Maryland) with distal breadth given 21.1. In my 1966 paper I ruled it out because all specimens then known from Sharktooth Hill were smaller than M. loxostylus. (see Howard, 1966 p. 6).

1602 ✓

Uma

Tarsonetatus

UCLA
S. williamsi 2839 length 43.8-44
DSB #120432 length 44.4
(see cranium below)

98601 no comp. (dark head) g. 12.0, head width 12.0
length to claw. foot 43.2 int. length to scape foot 35.4

Chromolaena

123341 du 3162 length 77.6

OSO Dam Suidae

Humerus
 182 120433 left ^{anterior} - length 184
 12431 dist - gr l. 21.0
 177.4 124547 Rashed 555 inc but length est'd - 177.4 dist 19.5?

OSO humeri 177.4 - 184 length

no humeri as small as willkii

BUT see tarsus

Tarsometatarsus
 44.6 120422 - length estimated 44.6 [referred to willkii UCL 2839, 43 or 44]
 size of willkii type 41.0

coracoid
 120428 shaft (6.1) gr. br. (12.3) (fits depression on ? willkii referred UCL 2839)
 defende where you measure
 defende where you measure
 through shaft part

Carpometacarpus
 72.8 4547 Rashed 555 - length 72.8 or 73.0

willkii 70.0

Radius
 4547 Rashed 555 - dist br. 11.5

Dear Ken:

Almost a month since I received your letter of Nov. 27. You brought up some points that I hoped to be able to clarify, but it took a couple of Museum trips to do it.

First, regarding that associated skeleton with the carpometacarpus of 72.8 mm length. Your comments about what the humeral length "should be" prompted me to study it in more detail. I found that I could detect a faint outline in the matrix which suggests the proximal rounding of the bone. In that case the length would be 177.4 mm. rather than 166. You ask what "conversion I used to get the 166. It was not conversion, it was measurement on the bone. Now that I see this

First regarding the associated skeleton with the carpometacarpus of ~~72.8~~ 72.8 mm. You asked what "conversion" I used to get the figure 166. That was a measurement of the bone itself. However, your comments prompted me to examine the specimen more fully, and I found that I could detect a faint outline in the matrix which suggests the proximal rounding of the bone. In that case, the length would be 177.4 mm rather than 166. However, the specimen is really too poorly preserved to base too much on measurements other than the complete carpometacarpus. ~~which is the way it is now going to be~~
~~XX~~
~~XX~~

I have gone back over the notes I made before you decided to take on the "big job." I enclose a copy of some of the assignments I had made. I would be interested to see how my ideas fit in with your more detailed study now. *Dashed lines also on a bone you see with the humerus*

I also had made a ^{note} list of maximum and minimum sizes for various elements from Oso and Sharktooth Hill. These are as follows:

	Humerus	Sharktooth Hill	OSO
smallest	Length LACM 98601 155.9		Raschke LACM loc. 45417
	dist.br. 16.8		177.4 brs?????
largest	Length LACM 7432 170.0		largest LACM 120433 184 length
	dist. br. 18.5		
	516601 dist. 20.5		
	dist. br. 16.2 (LACM 72817		
	122992 21.8mm		

~~XXXXXXXXXXXXXXX~~

distal breadth

16.2 (LACM 72817)

21.8 (LACM ~~XXXXXX~~ 122992

tyoe vagabundus 18.3

Length 155.9 (LACM 98601)

170 LACM 7432

Do not have length on those
with broader distal ends

length 177.4 est. (uncalculated)
184 (LACM 120433
dist. br. *can't measure*

I would prefer now to

2045-QVia Mariposa East
Laguna Hills, CA 92653
Decdmbber 9, 1985

National Wildlife Federation
1412 Sixteenth Street, N.W.
Washington, D.C. 20036-2266

Dear friends:

In November I ordered Christmas cards from you.
Two boxes of "America's Trees" (No. 13233) and one
box of "Silent Night" (no. 13158). I enclosed a
check for \$37.50.

The two boxes of America's Trees have arrived.
But the one box of Silent Night has not. Is it coming?
I surely would like to have it even at this late date.

If you cannot send it, then please refund the
price of that one box.

Yours sincerely

Hildegarde Wylde
(Mrs. Henry A. Wylde)

*didn't have to send
Came next day*

Localities 4545, 4546 and 4547
 Subfamily Mancallinae (family Aleidae)
 Referred to Alcodes cf Ulnulus Howard (Holotype loc 1945)
 all ulna

Ulna LACM # 120434 Loc LACM 4546 Apr 23, 1980

coll
Barner
[2200]

Length from internal cotyla to distal internal tubercle
 29.4 mm, Holotype same meas. 27.6 mm
 27.5 ext cotyla
 28.5 mm
 Breadth/depth of shaft 2.9 x 3.9 (Holotype 2.9 x 4.3)
 (referred to 2.8 x 4.1)
 Depth distal end externally 5.3 mm (type 5.35 mm)
 (loc 1945 referred 5.56)
 Breadth distal tubercle 3.7 mm (type 3.75 mm)
 (loc 1945 referred 3.9)

Also referred to Alcodes

Coracoid LACM 121010 Loc. 4547

coll Bruce Nelson
12 Apr. 1979

loc 4547
[BJW 79-IV-12-2]

Length to center of sternal end 34.3 mm
 (No coracoid of Alcodes for reference;
 smallest Mancalla milleri 38.5 mm)

Breadth below head 3.3 mm
 (Specimen from loc 1945 labelled "Alca"
 measures 3.8 mm)

Distance from top of glenoid

facet to below scapular

facet 7.5

Same in "Alca" from 1945

loc 1945

Same in Cerorhinca 8.6

mm scale

3.9 x 5.6 = R/L of glenoid facet
 in 121010

4.0 x 6.3 in Cerorhinca mm

4.1 x 6.5 in M. milleri

4.5 x 6.4 in "Alca"

Distance from head to lower edge of scapular facet 11.9 mm
 (Same specimen of "Alca" [LACM 18282] from
 loc. 1945 measures 12.5 mm)

Coracoid resembles Cerorhinca in straight internal
 contour, but differs markedly in having a
 very narrow sternal facet/suggestive of
Mancalla milleri of subfamily Mancallinae,
 Though less extensive internally.

Humerus LACM 120414 Loc. 4545 Very eroded

Differs from Mancalla in more pronounced
 (crest-like) ridge internal to pectoral attachment

Length (lack of complete ends) 54.4, maximum could be
 55.6 mm. (Smallest Mancalla milleri 56.4 mm)

Shaft measurements 2.9 x 4.7 mm

coll Barner
3 Jan 1980
[3165]

M
ratio length humer / ulna / coracoid

Oso Dam locality

76.5

29.4

49.1

diegensis

4545-4547

62.7

25.3

40.0

milleri

loc 4542+47

* See #s below

✓ 57.1?

31.0

34.2

81.5

36.7

?

Praemancalla

mins.

71.0

28.0

47.5

diegensis

56.4

23.4

38.5

milleri

✓ 57.1?

31.0?

34.2

Oso dam

68.6

56.3

33.6

Cephus columba #1174

49.1

37.0

22.4

Syntherismaulius

46.2

40.0

23.7

Ptychocaulus alutus

30.0

sh br

2.9 x 4.1

type Alcedo ulmus

L Km 120434 alcedo ulna from loc 4546 Oso Dam

L Km 120414 humer " " " 4545 " "

L Km 121010 " coracoid " " " 4547 " "

120434 ulna length 29.4 from internal coracoid to internal trochlea (distally)

type ulna of Alcedo ulmus same ^{meas. of} length - 27.6

120434 br x depth shaft 2.9 x 3.9 (type 2.9 x 4.3)

120434 depth dist 5.3 (ext.) (type 5.85)

" br dist trochlea 3.7 (" 3.75)

121010 coracoid length (to central) 34.3 (smallest milleri 38.5)

br below head 3.3

(alcedo " from 1945 #18282) 3.8

proend to base of scapula 11.9

(" " " " 12.5)

Coracoid internal contains straight (not flared distally). Resembles Ceanothus in this but differs markedly in very narrow sternal facet, unzeigahisic to middle, but less internally extensive

Humerus 120414 very eroded. Differs from Praemancalla in more pronounced (crest like)

capital shaft ribs internal to pectoral scar

The length is 55.6 allow at least 4mm more 2.9 x 4.7 = shaft meas

(very slender but not as deep as Praemancalla)

smallest milleri length 56.4

(paratype 58.2 with length sh 8.3 x 3.6)

(incomplete)
51.7 head to
notch to ext coracoid
smaller m. milleri
same meas 52.8
but head is complete

Phone call at L Km 10.7.80
Nils Bjo Chandler has an albatross
bone from San Diego for me

Check these specimens for
comparison with Oso Damm
Loc 1945. size closest to diatom height of ectopodites^{less tho}

Puffinus calliornis type distal humerus 17508

referred humerus (dist.) 17539

" prox ulna 17530 mini. opistho

heavenly

104058 from 2nd

" prox tarsus 17582

2 tarsal shafts with hypotarsus 17524

P. princeps distal humerus 17548 larger than
calliornis.

prox part of shaft of ulna 17547

X prox tarsus 17538 larger than
17582

Presbychen X prox part tarsus 17552

femur 17553

shank tooth

X *Presbychen* prox tarsus 14466

Laguna Miguel

Puffinus larnesi type left humerus (distal) 42452

size range of opisthomerus

left ulna minus olecranon 42654

Diomedea radiata ~~humerus~~ humerus than princeps

ulna 556.

1753925 distal

larger than Oso 17539

Sulmaur hammer
Sulmaur maccanus

newulma r
capu

Puffinus ?n. sp.

Material available. From locality 4546, associated complete but poorly preserved right humerus, crushed proximal end of ulna and proximal and distal ends of radius, LACM 120422. Collected April 23, 1980 by L.G. Barnes.

~~Discussion~~ *The humerus to* *This element in*
Description. Distinguished from both *P. priscus* and *P. mitchelli* *5/18/85* *2 hum* *5/8/84*

from the Round Mountain Silt of Sharktooth Hill, in having ^a more rounded, less flattened shaft. Length falls between these two species:

LACM 120422, 90.4 mm, *P. priscus* 80.2-82.2mm, *P. mitchelli* 98.1 mm. Poor preservation makes difficult detailed comparison with *holotype* of *P. inceptor* (also from Round Mountain ~~silt~~) appears to lack of notable ³ a distal end of humerus

120422 however ~~by~~ ^{different} ~~by~~ ^{different} internal thrust of the entepicondylar prominence. *120422 humerus is* *holotypes of Late Miocene*
~~xxxx~~ characteristic of *P. inceptor*. Larger in size than *P. calhouni* from Orange County locality LACM 1945, ⁵ ~~xxxx~~ *P. barnesi* from Orange County

Poor preservation makes difficult comparison with *P. inceptor*, *holotype* distal end of humerus absent of which *P. inceptor* has. *Calif. local 1945*

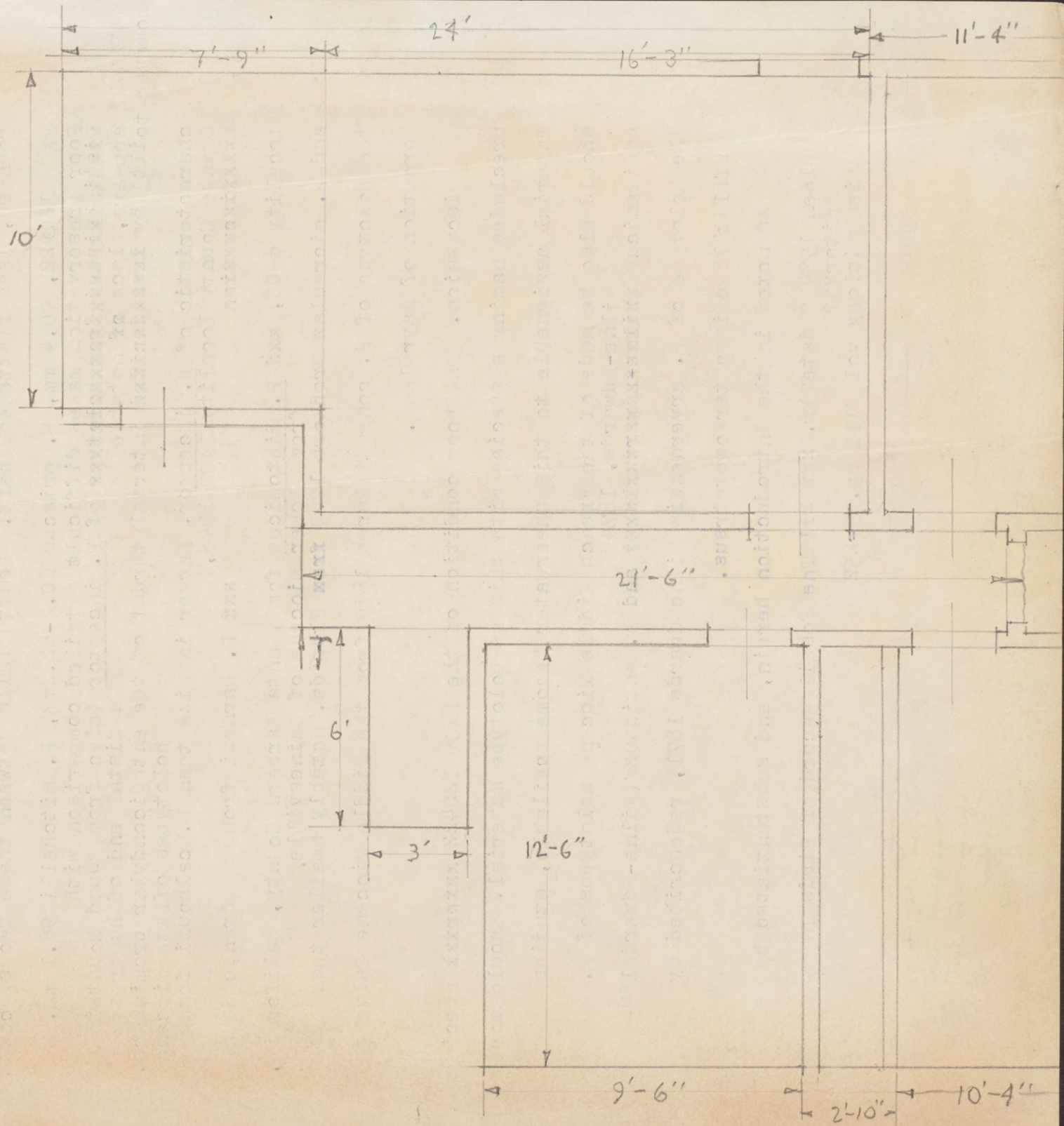
locality 6906, ~~xxx~~ *P. diatomicus* from Santa Barbara County, California, from Lower Miocene of Gainesville and *P. micraulax* Brodkorb 1963 ~~xxxx~~ Florida, ^{1 but is} Notably smaller than the holotype of *P. conradi* Marsh 1870 from the Middle Miocene Calvert Formation of Maryland.

Discussion. The poor condition of the LACM 120422 ~~xxxxxx~~ specimens. precludes naming a species with this as holotype material. Should more material assignable to this shearwater become available, studies should also be made of the French Middle Miocene ~~holotypes~~ of *P. aquitanicus* ^{Milne-Edwards, 1874} ~~(Milne-Edwards 1874)~~ and *P. antiquus* (Milne-Edwards 1874) The holotype of *P. arvernensis* Milne-Edwards 1871, redescribed by Shufeldt 1896 is a tarsometatarsus.

As noted in the Introduction herein, and substantiated by Olsen 1984 ⁵ (date?) p. 22x 211 The Fossil Record of Birds IN Eitor??? Avian Biology vol VIII pp.79-252 — *There are 6 sps of Puffinus now known from mid of Calif.*

- Sulidae* *Calif.* *Sula* *villae*
Morus *longicauda*
Morus *medea*
Morus *vagabundus*
Sula *pallasi*
Puffinus *hutchinsoni*
Morus *maurus*

- Procellariidae* *Puffinus* *priscus*
Puffinus *mitchelli*
Puffinus *hutchinsoni*
Puffinus *inceptor*
P. calhouni
P. barnesi
Sulmaur *maccanus*
S. hammer



I discovered another *Sula* specimen from Sharktooth Hill that you had evidently overlooked. It was collected in 1970 by Paul Kirkland from loc. 3499. It includes ^{in a piece of rock} a complete humerus (broken in two at present) a coracoid with proximal end partially covered by matrix & with a scapula beside it; also ~~the~~ proximal & distal ends of an ulna and a distal end & shaft fragment of radius.

The ulna has the characteristics of *monis*, i.e., absence of pneumatic foramina in the cotylar end and a single foramen on the internal side of the proximal part of the shaft. Measurements agree surprisingly well with those given by Miller for *Sula wellfleetii*.

Length of humerus 155.9

condylar width
12.8

dist breadth of humerus 16.5 prox br. humerus 21.1

length of coracoid (possibly not complete) 75.3

Jan 15, 85

ORDER PELECANIFORMES

Family Sulidae -- Boobies and Gannets

Referred material. From locality 4546: associated right and left humeri, ulnae and badly crushed radius, LACM 120433; associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; associated left coracoid and proximal fragment of shaft of left humerus. LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432; proximal end of radius, LACM 120429; proximal end of humerus, LACM 120430; distal end of humerus, LACM 120431; skull fragment, LACM 120427.

From locality 4547: associated incomplete radius and ulna, LACM 120438; humerus LACM 123910; associated seven incomplete and poorly preserved bones lying together in matrix with the following elements represented: proximal end of right humerus, three fragments of left humerus (approximate length 117.4mm), distal end of right radius, (fragment of left ulna), proximal end of left radius overlying left carpometacarpus (carpal length 121.8 mm) NO NUMBWR uncat.

Discussion. This material will be included in Kenneth Waeheit's study of the family Sulidae now underway at the University of California.

Based on size alone, the specimens appear to represent at least two species, one of which is obviously too large to conform with the description of *Morus vagabundus* Wetmore 1930. ~~the only sulid described from Sharktooth Hill.~~ The holotype of *M. vagabundus* is a distal end of humerus with breadth of distal end 18.3 mm; a ~~additional material recorded from Sharktooth Hill (Howard, 1966) included a humerus of approximately the same distal breadth, and a length 170 mm. Specimen LACM 120433 from Oso Dam has a length of 183 mm.~~

~~The other extreme in size is noted in the~~ The other extreme in size is noted in the associated bones bearing number LACM 120428. Though the humerus cannot be measured, the coracoid and tarsometatarsus agree in size

PRESENTING
LAGUNA BEACH MUSEUM OF ART
TOUR COMMITTEE'S
FALL TOURS

TOUR I WEDNESDAY, SEPTEMBER 13 9:00 a.m. - 3:30 p.m.
LOS ANGELES COUNTY/CRAFT AND FOLK ART MUSEUMS
TWO SPECIAL SMITHSONIAN INSTITUTE TOURING EXHIBITS,
AT LAC, TREASURES OF MEXICO. AT CRAFT AND FOLK ART,
FRENCH FOLK ART. TREASURES OF MEXICO IS A VERY
SPECIAL EXHIBIT, ONLY VISITING A FEW OTHER MUSEUMS
IN THE COUNTRY. LUNCHEON PROVIDED.

TOUR II WEDNESDAY, OCTOBER 11 9:00 a.m. - 3:30 p.m.
THE J. PAUL GETTY MUSEUM
VISIT THE EXCITING GREEK AND ROMAN ENVIRONS,
WE WILL HAVE A 20-MINUTE DOCENT TALK IN THE GARDENS
BEFORE ENTERING. AUDIO CASSETTE TOURS AVAILABLE
FOR YOUR RENTAL. LUNCHEON PROVIDED.

TOUR III WEDNESDAY, NOVEMBER 8 9:00 a.m. to 3:30 p.m.
FINE ARTS GALLERY OF SAN DIEGO
AN EXHIBIT OF REMBRANDT ETCHINGS, MODERN
ITALIAN SCULPTURE AND AMERICAN PAINTING WILL
BE ON DISPLAY. LUNCHEON PROVIDED.

EACH TOUR IS \$15.00 PER PERSON, WHICH INCLUDES THE BUS, THE
MUSEUM TOUR AND A VERY LOVELY LUNCHEON, WON'T YOU JOIN US
FOR WHAT WE FEEL WILL BE AN EXCITING FALL OF TOURS.

WE WILL MEET AT THE MUSEUM AT 8:30 a.m. FOR EACH TOUR.

----- -TEAR HERE- -----
TO: IAGUNA BEACH MUSEUM OF ART, TOUR COMMITTEE, 307 CLIFF DRIVE,
LAGUNA BEACH, CALIFORNIA 92651
YES! I WOULD LIKE TO JOIN YOU.

NAME _____

ADDRESS _____ Phone _____

CITY _____ Zip _____

TOUR I LAC/CRAFT AND FOLK ART MUSEUMS
(deadline Aug. 30) _____ seats at \$15.00 _____

TOUR II J. PAUL GETTY MUSEUM
(deadline Sept. 27) _____ seats at \$15.00 _____

TOUR III FINE ARTS GALLERY OF SAN DIEGO
(deadline Oct. 25) _____ seats at \$15.00 _____

Total enclosed _____

Make checks payable to Laguna Beach Museum of Art
You will receive notification of receipt.

with those of a referred specimen of *Sula willetti* figured by Miller (1925^{pl. 8}) without discussion. The specimen was available for this study. ~~THESE~~ Both the coracoid and tarsometatarsus are in close agreement with comparable specimens in the ~~impressio~~ UCLA impression.

Sula willetti has not been recorded from ~~Sharktooth Hill~~ the nearby ~~xxxxxx~~ Orange County locality (LACM 1945) or Sharktooth Hill. However, several small bones, were noted from the Locality LACM 1945 (Howard, 1968) as ~~xxxxxx~~ being comparable in certain characters with *Microsula avita* Wetmore 1938, which appears to have been similar in size to *Sula willetti*. ~~xxxxxx~~ ^{unrecorded} In the Sharktooth Hill material, LACM 99601 consisting of associated humerus, ulna and coracoid, is also of small size (humerus length 155.9 mm, distal breadth 16.5 mm) ^{proximal} The ~~xxxxxx~~ ^{156mm} holotype humerus of *S. willetti* is listed by ~~xxxx~~ ^{lunene} at ~~xxxx~~ (Miller, 1925:114) ^{21.1}



Laguna Beach Museum of Art

307 Cliff Drive/Laguna Beach, California 92651/(714) 494-6531

March 1, 1978

MUSEUM BOARD OF DIRECTORS

Mrs. Nick B. Williams, Pres.
Harry Lawrence
Edward Behme
Leon Jones
Beatrice Williams
Alton Allen
Mrs. William Bruggere
Charles Culp
Hub Keavy
Pierre Poisson
Eric Smith
Andy Wing

HONORARY BOARD OF DIRECTORS

Daniel G. Aldrich, Jr.
Roger Armstrong
Rex Brandt
Paul Darrow
Wanda and John Dundas
Pete Fulmer
Patricia R. Hitt
Richard Jahraus
Gerard LeBeau
Howard and Alleyne Lyon
Jack McDowell
Mrs. John McLaughlin
Lorna Mills
Mrs. Andrew Morthland
Virginia and Norman Nixon
Muriel Reynolds
Supervisor Tom Riley
Louis and Dorothy Routh
Ruth Osgood Salyer
Mr. and Mrs. Daniel Schryver
Mr. and Mrs. Henry Thomas Segerstrom
Donna Sharkey
Millard Sheets
Richard Steinbach
James Strombotne
Louise Turner
Mr. and Mrs. Donald B. Vanderbilt
Jane (Mrs. Will) Ward

Dear Member:

In a recent presentation asking for a sizeable grant for the Museum Endowment Fund this statement was made about our objectives:

Our first objectives are to increase our permanent endowment and to enlarge our public membership. More money will enable us to upgrade the quality of our exhibits and thus to broaden their appeal. Even better exhibits will mean increased knowledge and interest in art for more people, more prestige for our community. And most importantly these objectives will mean richer, fuller and more rewarding lives for all Lagunans and South Coast residents.

Thanks in great part to Museum members, our permanent endowment is steadily increasing. As of this date there has been raised \$136,000 of the \$150,000 we set out, in January of 1976, to raise by the end of this year. Today that sum plus matching funds from the Harry G. Steele Foundation (\$273,000 in all) is drawing 6½% interest which helps us meet operating expenses. We are only \$14,000 short of our goal.

On July 19 we will reach the Museum's 60th Anniversary.

What better way of starting the celebration than by reaching our three-year goal on that day---about six months ahead of schedule.

I think we can do it.

Special events planned for the next four months should bring in about \$4,000 for the Fund. That leaves \$10,000 to go. If every one of our 1,000 members will contribute \$10, right now, we will have it made. We ask you to do it.

What a victory it can be. What a good all-overish-feeling it should give us all. And with such a great track record we will have proved to sources of big money grants that we are deserving of their strong support.

If you feel a larger contribution is appropriate please send it in. Or if a \$10 donation isn't feasible make a smaller contribution. But I urge you to be a part of what can be a great triumph in meeting our three-year objective. Early.

The enclosed postage paid envelope will make it easier for you.

For an ever greater Museum,

Barbara Steele Williams

Mrs. Nick B. (Barbara) Williams
President

The other extreme in size is noted in the associated bones LACM 120428. Although the humerus cannot be measured, the coracoid and tarsometatarsus agree in size with those of a referred specimen of Sula willetti, UCLA no. 2839 (Miller 1925, pl. 8), figured but not discussed. This specimen was available for this study. Both the coracoid and tarsometatarsus from Oso Dam are in close agreement with impressions of these elements in the UCLA specimen.

Sula willetti has not been recorded from Orange County LACM locality 1945 or Sharktooth Hill. However several small bones were noted from Locality 1945 (Howard, 1968) as being comparable in certain characters with Microsula avita Wetmore 1938, which appears to have been similar in size to Sula willetti. In the Sharktooth Hill material, LACM 98601 consisting of associated ~~xxxxxxx~~ humerus, ulna, and coracoid, is also of small size (humerus length 155.9 mm, distal breadth 16.5 mm.) The ~~holotype~~ humerus in the holotype of S. willetti is listed at 156 mm (Miller, 1925: 114).

Robert Chandler (in lit.) who has made a careful study of certain of the sulid family as part of a study of the San Diego Pliocene, favors reassigning Microsula to the genus Morus.

This would tie in well with specimen 98601 from Sharktooth Hill in which the both humerus and ulna show characteristics resembling Morus rather than Sula (distal end of humerus with olecranon medial border of olecranon fossa not overhanging the fossa, and ulna lacking multiple pneumatic opening below cotylae. *The areas cannot be clearly delineated in the impressions that form the holotype of S. willetti*)

The seven associated elements (LACM) possibly represent M. vagabundus. The humerus measures approximately 177 mm, the carpometacarpus 72.8 mm.

?
It should be noted that the humerus from

98601

The areas cannot be clearly delineated in the impressions that form the holotype of S. willetti

characters with Microsula avita Wetmore 1938, which appears to have been similar in size to Sula willetti.

The seven associated elements (1-7) consist of elements occurring in the same group. These are: 1. The large, dark, sub-rectangular element, 2. The small, dark, sub-rectangular element, 3. The small, dark, sub-rectangular element, 4. The small, dark, sub-rectangular element, 5. The small, dark, sub-rectangular element, 6. The small, dark, sub-rectangular element, 7. The small, dark, sub-rectangular element.

These elements are found in the same group. The elements are: 1. The large, dark, sub-rectangular element, 2. The small, dark, sub-rectangular element, 3. The small, dark, sub-rectangular element, 4. The small, dark, sub-rectangular element, 5. The small, dark, sub-rectangular element, 6. The small, dark, sub-rectangular element, 7. The small, dark, sub-rectangular element.

The elements are found in the same group. The elements are: 1. The large, dark, sub-rectangular element, 2. The small, dark, sub-rectangular element, 3. The small, dark, sub-rectangular element, 4. The small, dark, sub-rectangular element, 5. The small, dark, sub-rectangular element, 6. The small, dark, sub-rectangular element, 7. The small, dark, sub-rectangular element.

ORDER PELICANIFORMES
Family Sulidae -0 ^{Boobies} ~~Bpboes~~ and Gannets

Genus ? Sula -- Boobies

?Sula willetti Miller 1925

Referred material. From LACM locality 4546: associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432. From locality LACM 4547, associated incomplete radius and ulna, LACM 120438.

Discussion. The coracoid of no. 120428 fits the impression of this element in UCLA specimen no. 2839 from the type locality (Lompoc, California, Late Miocene) of Sula willetti Miller 1925 that was referred to that species (Miller, 1925, pl. 8), but not ^{agrees} The breadth of the coracoid is approximately 12.3 mm. discussed in the text. Tarsometatarsus no. 120432 also agrees in general dimensions with UCLA 2839 (approximately 44.6mm in length). The holotype skeleton of S. willetti (UCMP 26542) is said to be 4110 mm long (Miller, 1925: 114). The associated radius and ulna from LACM locality 4547 cannot be compared with the Lompoc material. The small size of these incomplete specimens, however, suggests the same species as represented in locality 4546. The shape of the radius resembles that of Sula rather than Morus.

(LACM no. 98601)

A small sulid/is represented in LACM locality 3499 at Sharktooth by a Hill complete humerus which measures 155.9 in length (S. willetti holotype 156 mm), and an incomplete coracoid with greatest breadth of 13.0 mm.

NOTE for Ken Warheit: You may have specimen no. 98601 in Berkeley by the time you receive this. But just in case you don't have it, the breadth of the humerus (greatest) is 16.8 mm distally and 21.2 proximally

Notes for
Ken Warheit

PELECANIFORMES

Family Sulidae -- Boobies and Gannets

Genus Sula Brisson

?Sula willetti Miller 1925

Referred Material. From LACM locality 4546: associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432. From locality LACM 4547, associated incomplete radius and ulna, LACM 120438.

Discussion. The coracoid of LACM 120428 fits into the impression of this element in UCLA specimen no. 2839 from the type locality of Sula willetti that Miller (1925, pl. 8) referred to that species without discussion. It is more slender than any sulid coracoid in the Sharktooth Hill collection. Tarsometatarsus 120432 has an estimated length of 44.6 mm, which also is in close agreement with the impression of this element in the same Sula willetti skeleton from Lompoc. In the holotype skeleton of S. willetti (UCMP 26542) the tarsometatarsus has a length of 41.0 mm.

The associated radius and ulna from LACM locality 4547 cannot be compared with the Lompoc material. The small size of these incomplete specimens, however, suggests the same species as that represented in locality 4546. The shape of the distal end of the radius resembles that of Sula rather than Morus in the more central position of the ridge on the ulnar surface. In Morus this ridge is near the internal edge, providing a broader, flatter surface.

Sula willetti has not been recorded from either Sharktooth Hill or the Leisure World locality. Several bones were, however noted from the latter locality as being comparable in certain

Topic

~~120429, 100000~~

discussing referred above to Sula ? willetti.

in this dimension.

Sulidae gen. and sp.?

*(Rachis 5.5" - wicket type larvae)
length 156
called by R. Raschke. (wider 147)*

D. Rasche 55534. *Wilecki type larvae*
called by R. Rasche. *Length 156*
Aug. 31 *Culmen 147*

elements represented: proximal and distal ends of right humerus, three fragments of left humerus with eroded distal end, proximal end of radius overlying a left carpometacarpus, distal end of right radius, anterior end of lower mandible in three pieces.

From locality 4546, LACM 120427, skull fragment; LACM 120428³
proximal end of humerus; LACM 120430², distal end of humerus;
LACM 120429, proximal end of radius. LACM 120430¹ - humerus
from loc 4547 material
Loc 4547
Dinner 123910

Discussion. The carpometacarpus is the only specimen that can provide a measurement of length. It is a nearly complete bone with a length of 72.8 mm and a depth of distal end 12.8mm, and depth of proximal end through the process of metacarpal 1 of 16.4 mm.

16.9
12.7

455
 1592.7 169.50
 6108
 8420
 7635
 7855

Length of coracoid *S. willetti* 2839
 40.5 mm?
 or or 89
 Length of humerus 42.8

ORDER PELICANIFORMES

Family Sulidae -- Boobies and Gannets

Genus Sula -- Boobies

? Sula ^{willetti} sp.

Referred material. From LACM locality 4546: associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432. From locality LACM 4547, associated incomplete radius and ulna, LACM 120438.

Discussion. The coracoid of no. 120428 fits into the impression of this element in UCLA specimen no. 2839 from the type locality (Lompoc, California, Late Miocene) of Sula willetti Miller, 1925 that Miller (1925, pl. 8) referred to that species. It is more slender than any sulid coracoid in the Sharktooth Hill collection. Tarsometatarsus 120432 has an estimated length of 44.6 mm which, also is in close agreement with the impression of this element in the same Sula willetti skeleton from Lompoc. The holotype skeleton of S. willetti (UCMP 26542), the tarsometatarsus has a length of 41.0 mm.

The associated radius and ulna from LACM locality 4547 cannot be compared with the Lompoc material. The small size of these incomplete specimens, however, suggests the same species as that represented in locality 4546. The shape of the radius resembles

that of Sula rather than Morus. ^{more curved} ^{distinct 1/2 the} In the position of the radius on the ulna surface ^{the end of the radius is nearer the ulna than in Morus, possibly a} Sula willetti has not been recorded from either Sharktooth

Hill or Leisure World. Several small bones, were, however, noted from the latter locality as being comparable in certain characters with Microsula avita Wetmore 1938, which appears to have been similar in size to Sula willetti.

In view of the fact that the humerus in the holotype of S. willetti is longer than the ulna (as in Morus) the generic assignment of willetti is subject to question.

Of the seven associated skeletal elements in the uncatalogued specimen from locality 4547, only the carpometacarpus provides a definite measurement of length (72.8 mm). This is in sharp contrast with two Sharktooth Hill carpometacarpi which measure 77.6 mm (LACM no. 12351 from locality 3162) and 79.3 mm (LACM 123980 from locality 4956). If the fragments of humerus in the specimen have not been disarranged since burial, the humerus may have had a length of 166 mm, a measurement not too far removed from that of LACM 7432 from Sharktooth Hill (170 mm) noted above.

Wahant says # 123351 from ST loc 3162 is 77.6 mm

Oso Dam

M. vagabundus

one good SH Hill humerus is only 155.9 (98601)

carpus of S. williamsi cast of holotype 66.7 length listed as 70 by Miller
humerus williamsi Miller spec 156 as length of humerus

dist of humerus 98601 loc. 3499 - 16.4
length 98601 " " - 153.9 or 154
with cranium & scap.

Type vagabundus dist end 18.3 2 mm larger than # 98601 SH T / 100

Ranke 555 The distal end of humerus appears to be close in breadth to a specimen of S. S. websteri LACM 86434 (811339)

157 which is 20.5 mm, length 177.4? Rankin 1748 S. S. websteri humerus

198 Carpus S. S. websteri 72.8

Ranke 555 also 72.8 carpus

166 Carpus 87.8 in m. basium length humerus 221
127 86.7 " S. dactylosteus length humerus 195
176 72.5 " S. websteri " " 177.8

160 100
35 718
195 2218

166 86.3
612 86.3
221 170.6

ORDER PELECANIFORMES

Family Sulidae -- Boobies and Gannets

Genus Morus ^{Vieillot} Gannets

~~Referred~~ Morus sp.

Referred material. From locality 4546: associated right and left humeri, ulnae and badly crushed radius, LACM 120433.

Discussion. These wing bones are assigned to the genus Morus, rather than to Sula, on the basis of the relative length of the humerus to the ulna -- humerus longer than ulna. The bones are larger than wing bones from Sharktooth Hill referred to Morus vagabundus Wetmore, the only sulid described from Sharktooth Hill. The humerus of LACM 120433 measures approximately 18^{5?} mm in length contrasted with humerus LACM 7432 from Sharktooth Hill previously referred (Howard, 1966) to M. vagabundus, with a length of 170 mm and a distal breadth ^{of 18.4 mm,} commensurate with that of the holotype (18.3 mm) ^{according to Wetmore}

Morus ?vagabundus Wetmore

Referred material. From locality 4547, associated ~~incomplete~~ skeleton; ~~seven poorly preserved bones lying together in~~ matrix, with the following elements represented: proximal end of right humerus, ^{distal end of right radius,} three fragments of left humerus, fragment of left ulna, proximal end of left radius overlying left carpometacarpus, anterior end of lower mandible in three pieces--uncatalogued.

Discussion. Only the carpometacarpus provides a definite measurement of length (72.8mm). The fragments of left humerus, however, unless disarranged since burial, suggest a length of ^{177.4?} 166 mm ^{no. LACM 7432 noted above} which is within range of the humerus from Sharktooth Hill/referred to M. vagabundus (Howard, 1966) with a length of 170 ~~xxxxxx~~ The carpometacarpal length, is notably shorter than two specimens of this element from Sharktooth Hill which measure 77.7 mm (LACM 12351 from locality 3162) and 79.3 (LACM 123980 from locality 4956). There is seemingly more similarity of size in these with the humerus and ulna listed above (LACM 120433 from Oso Dam locality 4546)

98601 → Vertical height ulna condyle 5.6 Wetmore 2.2 for vagabond type
 " " radius " 8.9 " 9.3

98601 or 3499

Ken Warheit - specimen of Sula you did not take
 Shankh Hill local 3499 March 24, 1970 prox. dist. ulna (see below)

Wetmore
 prox. radius
 of Sula
 ulna

Coracoid prox. scapula and ~~prox. half~~ of humerus right side
 Internal length coracoid 45.3 (Miller gives 45 mm for willeri coracoid)
 Prox br. humerus 21.1 Length of humerus 155.9 mm (same as willeri of mela)
 Dist br. humerus 16.5 br condyle only 12.8
 (vagabond br. 18.3)

Sept 1938
 166.2 Weller
 147.5 Miller
 21.1 1935

Humerus
 Sula leucogaster Brewsteri ♀ Mexico
 br. prox (as in specimen above) 13.3
 ♂ also from Mexico 20.2

dist. br. q.	condyle
19.5	15.4
16.7	12.4
21.8	
18.5	13.6

166.2
 177.4

holotype m. vagabondus
 uncataloged Oso

Carphobaculus leucogaster comb.

Length
134.2
134.9

Oso 72.83 mature adhou?

Ken Campbell
 will include 98601
 with the other
 material Warheit
 asked for

Zalidae

See Wetmore p. 91

Shankh	humeri	dist. br.
21.8	16.2	5.6
18.3	16.2	2.8

18.3 ← m. vagabondus

re skull + humerus of Sula willeri character
 compared to Morus being definite Sula.

The prox. ulna of # 98601 though similar in size to Sula
 leucogaster Brewsteri has the char. of Morus: i.e. absence of
 pneumatic openings below cotyloids and single orifice (?) on int. side of
 shaft prox. ly (more pneumatic in Sula)

19.5	166.2	147.50
16.7	147.5	
2.8	18.7	

185.6	18.3
155.9	
29.7	

RR431 *Puffinus lunatus*

Length 92.7 +

prox 15.2 +

diag dist 12.7 + (no toothless present)

dist's shaft 3.7/7.2 prox's shaft 5.0/6.3
very flat & deep >)

P. michelli 17500 from 1621

Length 98.2 (to same int. proc. near for RR431)

prox 17.7

diag dist 12.8

shaft double 4.2/6.6 prox's shaft 5.0/6.1

Ken: before you decided to take over the job of reviewing the Sulidae, I had made the following tentative notes regarding some large & small sulid bones, from the Oso Dam locality

FAMILY SULIDAE

Genus ?Sula -- Hoobies

?Sula willetti Miler 1925

Referred material. From LACM locality 4546, associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428 right tarsometatarsus lacking part of proximal end, LACM 120432. From locality LACM 4547, associated incomplete radius and ulna, LACM 120438.

Discussion. The coracoid of LACM 120428 fits the impression of this element in UCAL 2839 from the type locality (Lompoc, Calif, Late Miocene) of Sula willetti Miller 1925, that was referred to that species (Miller, 1925, pl. 8) but not discussed in the text. with max. breadth 12 mm in g.c.
120432 Tarsometatarsus no. 120909 also agrees in general dimensions with UCLA 2839 (length approximately 44.6 mm). The holotype skeleton of S. willetti (UCMP 26542) was given by Miller (1925:114) as 41.0mm. The associated radius and ulna from LACM locality 4547 cannot be compared with the Lompoc material. The small size of these incomplete specimens, however, suggests the same species as represented in locality 4546. The shape of the radius resembles that of Sula rather than Morus.

A small sulid (LACM 98601) is represented in LACM locality 3499 at Sharktooth Hill by a complete humerus which measures 155.9 mm in length (S. willetti holotype 146 mm @ Miller), and an incomplete coracoid with greatest breadth of 13.0 mm.

Sula willetti has not been recorded from either Sharktooth Hill or Leisure World locality ~~1945~~ LACM 1945. ~~xxxxxxx~~ Several small bones, were, however, noted from the latter locality as being comparable in certain characters with Microsula avita Wetmore 1938, which appears to have been similar in size to Sula willetti.

Ken: LACM 98601 will go to you soon

Genus Morus -- Gannets
Morus sp.

Referred material. From locality LACM 4546 associated ^{right} radius and left humeri, ulnae and badly crushed radius, LACM 120433.

Discussion. The wing bones are assigned to the genus Morus rather than Sula, on the basis of the relative length of humerus to ulna (humerus longer than ulna. The bones are larger than wing bones from Sharktooth Hill referred to Morus vagabundus Wetmore, both in length and in breadth of shaft. The shaft of the humerus is also notably larger than that of LACM 120428 from locality LACM 4546, discussed above as ?Sula ~~xxx~~ willetti.

Measurements. Length of humerus 185.6 mm; ulna length 158.6 mm, proximal breadth 14.1 mm. Length of humerus LACM 7432 from Sharktooth Hill referred to M. vagabundus (Howard 1966:5), fig. 1,J) 170 mm. Three Sharktooth Hill ulnae measure 11.2-13.6 mm in breadth of ulna.

UW
Genus Morus -- Gannets

Morus sp.

Referred material. From locality 4546; associated right and left humeri, ulnae and badly crushed radius, *LACM 120433*

Discussion. The wing bones are assigned to the genus Morus rather than Sula, on the basis of the relative length of the humerus to the ulna-- humerus longer than ulna. The bones are larger than the wing bones from Sharktooth Hill referred to Morus vagabundus Wetmore, both in length and in breadth of shaft. The humerus is also notably larger than LACM 120428 from locality 4546, discussed above as ?Sula sp.

Measurements. Length of humerus 185.6 mm, ulna 158.6 mm; length of humerus LACM 7432 from Sharktooth Hill referred to M. vagabundus (Howard 1966:5, and fig. 1, J), *170 mm*. *prox. br. 14.1* (Proximal breadth of ulna 14.1 mm. Three Sharktooth Hill ulnae measure 11.2-13.6 mm in this dimension, *prox. breadth*.)

Measurements
from Sharktooth Hill referred to M. vagabundus (Howard 1966:5, and fig. 1, J) 170 mm, *ulna length 158.6, prox. br. 14.1*
Sharktooth ulnae measure 11.2-13.6

Sulidae gen + sp?

Referred material. Loc. 4546

- 120429 - prox radius loc 4546
120433 - associated humeri (2) ulnae (2) radius loc 4546
120427 - skull fragment loc 4546
120430 - humerus prox loc 4546
120431 - humerus dist loc 4546
120438 - assoc. radius & ulna loc 4546
120428 - coracoid & humerus shaft loc 4546
123910 - humerus loc 4546
7 uncat. - left & rt inc. humeri
lower mandible
carpometacarpus
prox radius left
dist radius rt
big left ulna

Aug 9, 1981 - loc 4547

Unidentified to family distal end femur 120436 loc 4546
Iran Bm 2 Aug 1980
Probably Sulidae

distal end tibia (unclassified)
loc 4547

?? too narrow for sulid

Genus Morus Viellot -- Gannets

Morus sp.

Referred material. From locality 4546: associated right and left humeri, ulnae and badly crushed radius, LACM 120433.

Discussion. The wing bones are assigned to the genus Morus rather than Sula, on the basis of the relative length of the humerus to the ulna--humerus longer than ulna. The bones are larger than the wing bones from Sharktooth Hill referred to Morus vagabundus Wetmore, both in length and in breadth of shaft. The humerus is also notably larger than LACM 120428, from locality 4546, discussed above and referred tentatively to the genus Sula.

Measurements. Length of humerus 185.6 mm, ulna 158.6 mm; length of humerus LACM 7432 from Sharktooth Hill referred to Morus vagabundus (Howard 1966, ^{P. 5} and fig. 1, J) 170 mm. Proximal breadth of ulna ^{LACM 120433} 14.1 mm. Three Sharktooth Hill ulnae measure 11.2-13.6 mm in this dimension. *There are no complete ulnae from Sharktooth Hill.*

Sulidae gen. and sp.?

Referred material. From locality 4547, collected by RERasche in August 1981, uncatalogued; ^{associated} seven incomplete bones lying together in matrix with the following elements represented: proximal end of right humerus, three fragments of left humerus with eroded distal end, fragment of left ulna, proximal end of left radius overlying left carpometacarpus, distal end of right radius, anterior end of lower mandible in three pieces. From ^{locality} ~~locality~~ 4546. skull fragment, LACM 120427; proximal end of humerus, LACM 120439; distal end of humerus LACM 120431, proximal end of radius, LACM 120429.

Referred material. Frp, ;pca;otu 4546" associated logs and
;eft ji,ero. i;mae amd bad;u crisjed radins. LACM 120433.

Discussion. Of the associated specimens from locality 4547, the carpometacarpus is the only specimen that can provide a measurement of length. It is a nearly complete bone with length of 72.8 mm, an depth of distal end 12.8 mm and depth of proximal end through process of metacarpal 1, 16.4 mm. ^{Two} /Complete carpometacarpi from Sharktooth Hill measure 77.6-79.6 mm in length. Proximal and distal measurements possible on the shorter of these Sharktooth? ^{HILL} bones (LACM 123351) are 16.9 mm and 12.7 mm respectively.

The disassociated specimens from locality 4546 are too fragmentary to provide measurements.

Unus 2 pulk
~~157~~
174?

ORDER ANSERIFORMES

Family Anatidae -- Ducks, Geese and Swans

Tribe Mergini -- Divers

Referred material. From locality 4546, distal end of left femur, ¹²⁵⁹⁹⁴undatalogued, collected by Museum field party Aug. 1981

Discussion. This femur represents a large diving anatin, goose-like in size, and in general conformation is suggestive of undescribed specimens of femora from the Round Mountain Silt at Sharktooth Hill. It is, however, more slender, and the muscular scar on the internal side of the posterior face is more proximally placed. Anteriorly the intercondylar area appears to be more deeply excavated, but allowance must be made for the poor preservation of the specimen.

The Sharktooth Hill femora and other related elements of the skeleton are still under study. It is anticipated that a new species, and probably a new genus, will be established. The single bone from Mission Viejo indicates ^{anatin}presence of a large diving ~~goose~~ in the south Orange County area at the same time as the existence of such a bird--probably generically similar, but specifically distinct-- occur^{red} in the Kern County area.

The only anseriform specimen described from Sharktooth Hill is Presbychen abavus. The holotype distal end of tibiotarsus is clearly distinguishable from the nearly complete specimen of ^{now available from Sharktooth Hill}this element/representing a diving form.

In Es. distal end 20,7
Tibular condyles thrust laterally as in *Chendytes* & *Anas* ducks
and deep angular depression by medial
process, above condyles as in
Somateria
magus
Aythya

HELLO from HILDEGARDE

Dear Larry:

After hearing your talk last Thursday, I thought you would probably like to have a run-down on how things are progressing with the birds.

The enclosed is a short run-down of what I have accomplished so far

HH

June 9, 1983

Hildegard -

This is just perfect for us to ^{include in} ~~use on~~ the updated faunal list and for any paleo-ecologic study. But, there is a lot of new data here that I believe you should put in a separate paper on "New data on STH birds"-or such.

I have asked Howard Hutchison to send you the Branta & Recurvirostra of Miller, 1961.

Larry Garner

14 June 1983

June, 1983
HHoward

Fossil Birds from Sharktooth Hill

2 pages

LOONS and GREBES -- Do not appear in California deposits until
Late Miocene

ALBATROSSES -- Diomedea californica Miller and D. milleri Howard

Diomedea sp. (possibly n.sp.)
Total LACM specimens 18, from 8 LACM localities

1557, 1625, 1655, 1622, 4173, 6688, 3205, 3230, 3162, 4956

SHEARWATERS -- Puffinus inceptor Wetmore, Puffinus priscus Miller,
Puffinus mitchelli, Puffinus sp. (unidentified bones
that probably belong to one of the identified species).
Total LACM specimens 38 from 8 LACM localities

1557, 1622, 1625, 1655, 3160, 3162, 4956, 6688, 4103, 3230

FULMAR -- Fulmarus, n. sp. One bone from LACM loc. 3162. First
fulmar record from Sharktooth Hill. Only one other
extinct fossil fulmar recorded (from Late Miocene)

PELICANS -- Do not appear in California deposits until Pleistocene

CORMORANTS -- None at Sharktooth Hill. Earliest record in Modelo Fm.
in Calabasas.

SULIDAE (Booby-Gannet Family) -- Morus vagabundus Wetmore the only

species recorded from Sharktooth Hill. There appears
to be another species (of larger size), but much more
study is required. (Note: A larger form appeared in the
Upper Oso Dam material, also)

This family is no longer native to California, but
occurs abundantly in fossil deposits. At present the
nearest breeding site for boobies is Baja California;
the gannets occur on the Atlantic coast and North Atlantic.
(the genus Morus is a gannet). Total Sharktooth Hill
specimens 63 (at least). The best represented group.

Specimens found in 12 LACM localities: 1557, 1622, 1625, 1655, 3160, 3161, 3162, 3499, 3360, 4173, 4956, 6688

BONY-TOOTHED BIRDS -- Osteodontornis ?orri. I have not studied the
material in detail. The best specimens are on loan to
Storrs Olson. Five LACM specimens from 5 localities

1557, 1622, 3230, 3499, 4956

ANATIDAE (Water bird family) -- Presbychen abavus Wetmore described
as a goose. The 14 specimens from 7 LACM localities
indicate that it was more closely related to the diving
sea ducks. Found in LACM locs. 1557, 1625, 3230, 3161,

3162, 4956, 6688

Branta sp. was recorded by Miller on the basis of a
proximal end of ulna (UCMP specimen, possibly loc. V2401,
though the locality was not noted in reference to Branta).

FLAMINGOS -- Megapaloelodus sp. Two species of this genus have been
described (M. connectens from the Miocene of So. Dakota,
and a slightly smaller species, M. opsionus from the
Pliocene of Oregon. I referred a few bones from the
Almejas Fm. to the latter sp. Otherwise all the material
is from stream or lacustrine deposits. There are 3
specimens referable to this genus from Sharktooth Hill
from LACM locs. 1622, 1625 and 6688 (the latter specimen
is a cast of one from UCMP collection)

Tibia 4672 (Sg-30-A-F) Storrs?

SHOREBIRDS -- Miller (1961) recorded an Avocet, genus Recurvirostra, on the basis of a distal end of ulna. I have not found anything to compare with it in the LACM material from Sharktooth Hill (Perhaps among the fragments?)

Questions
Have now seen the
specimens at
UCMP
Recurvirostra
any more

Otherwise there are no members of this Order represented at Sharktooth Hill (although the flamingos are now placed there by Olson and Feduccia). Auks do not appear until the Late Miocene.

FALCONIFORMES -- the Osprey, Pandion homalopteron Warter from LACM loc. 3205 is the only representative of this group at Sharktooth Hill. *All bones of one specimen?*

NOTE: In order to finalize the Sharktooth Hill bird list, perhaps we should borrow the Branta proximal end of ulna and Recurvirostra distal end of ulna from UCMP. The locality and specimen number were not given for either. However, the two new species described in the 1961 paper both came from UCMP locality V2401, so these other bones may be from that locality as well.

"Storks" - 2 bones

Ciconiidae distal phalanx loc 4622 / Sq-304-B (unidentified)
show similarity
to Mycteria prox ulna 1622 / 104081 (Kubler 1976)

Notes

- ① Standard for comparison is the birds from the Sharktooth Hill local fauna, found in the Sharktooth Hill Bonebed. The bonebed is but one fossil-bearing horizon of many in the Round Mountain Silt, which ranges in age from Late Early Miocene to Middle Miocene.
- ② Diomedea is near size D. milleri from Sharktooth Hill, but slightly different morphologically.

Puffinus priscus like STH sample.

Puffinus, possibly new species, also present.

Other Puffinus; 2 spp., one ? P. priscus.

Sulidae, smaller than M. vagabundus,

Anatid, near undescribed STH species,

Alcedo pulchellus, not at STH. but poss. ancestor of form in Monterey fm.

page 1 - ref to Morton et al / does it go before or

① after the data about new ideas on topography location

7, ② ref. here should be Morton et al? - full name in
Abstract only,
? in parentheses?

A name which is probably no longer affiliated in Orange Coast,
or leave to page out entirely.

check of ^{author} Melander - Sometime # 125994

Larry: I have a xerox of this manuscript.

See suggested list of illustrations (last page)

Your suggestions will be welcome welcome WELCOME!

Hildegard

4.1.86

I added comments on geology, geography and stratigraphy, on the relationships of some of the taxa, and expanded the Conclusions.

I suggest, if you approve the editing, to have it typed immediately on the computer for the next draft.

Larry Banner

FAMILY Procellariidae

(1) 4 B

June 11, 85

Genus Puffinus -- Shearwaters

There are 26 bones of 18 individuals assigned to the genus Puffinus
The genus Puffinus is represented by 26 bones of 18 individuals.

At least two species are represented.

Puffinus priscus L. Miller 1961

7 of 8 inch

REFERRED MATERIAL. From LACM Locality 4546: associated left and right humeri and proximal 3/4 of right ulna (no. 120416; nearly complete humerus) no. 120415; distal end of right humerus (no. 120417); right tarsometatarsus (no. 120419); proximal 3/4 3/4 humerus (uncatalogued).

DISCUSSION. The humeri agree in size and characters with the holotype (distal end) of P. priscus as well as with additional more complete specimens now available from Sharktooth Hill referred to P. priscus. The tarsometatarsus is so assigned based on comparison with two tarsometatarsi in the Sharktooth Hill collection, both of which are of greater size than the Oso Dam no. 120419 ~~xxxxxxxxxxxxxxxxxxxx~~
~~xxxxxxxxxxxxxxxxxxxx~~ Puffinus priscus

Puffinus ?n. sp.

4 of 2 inch

REFERRED MATERIAL. From LACM locality 4546: associated complete (but crushed) ~~xx~~ right humerus, proximal end of ulna (very crushed), proximal and distal end of radius (no. 120422); uncatalogued humerus ~~(K)~~ R. Rasche 431).

DISCUSSION. The possibility of assignment ^{of this material} to P. inceptor Wetmore ~~xxxxxxxxxxxxxxxx~~ ~~xxx~~ described on the basis of a single distal end of humerus. ^{was counted} The only complete humerus from Sharktooth Hill that could possibly represent P. inceptor is ^{crushed} markedly shorter than the humeri from Oso Dam. This material will require further careful study.

KEEP

complete
large SH A

ulna #124359 (SHT)

complete 50
large

ulna 120420

small
shell assoc with process
2 ulnae

ulna 120416 050

2 length 85.2
wt 83.6
prox br 8.2
ray depth 9.4
dist br 4.7
dist depth 6.2
ex-
mr dist br sh 4.0
depth sh 4.7
mr prox br sh 4.3
dist sh 5.7

95.6
89.5
—
5.8
6.8
4.0
4.6
4.9
5.6
124360
050
—
—
4.3
5.8
4.7
4.6
4.4
3.9
4.8
7.2
8.4
—
—
4.0
4.4
3.9
4.8

120422 Surmear

90.4 sp?

Sp?

14.8 br prox

With ulna head
is sawn back

10.8 br dist q.

16.0 ectepi hit

Feb 14, 88

Added material

Oso Dam

① Assoc. with bones + mandible Seelid
73.5 mm inc length carpometacarpus with incomplete Seelid skeleton
added to Oso material L. 4547 R. 4547 Brief 9, 1981
fragments of humerus and partial lower mandible (dist part radius??)
(+ prox part ")
(prox part is across the prox end of the carpo.)

Pr. of dist end of humerus 20.5? (still embedded)

Br. for end humerus — 19.3 across ~~dist~~ biapertur crest to distal end
(24.8 in M. Cassanus)

→ Type 'vagabundus' dist end 18.3, M. Cassanus 23.8

Breadth mandible 7.5 in fused area (5.0 in M. Cassanus)

Appears heavier than Cassanus

Compared to M. magnus the carpometacarpus is much shorter

Thus the heavy beak suggests magnus. ~~It is~~ ~~could be~~

inside the bone Could also go with 37614 from Miguel 6906 referred to Lumpocanus

Depth humerus 11.8? = M. vag. ?? incorrect measurement

However, note that the carpometacarpus from Miguel is close to that of Lumpocanus in length ^(94.7 + 95.7) + notably longer than the one with this Oso Dam skeleton (73.5)

② Puffins sp. humerus CRRY31 19817 Ranche

Same near. 120422 1980
length 89.9

prox br. 15.5

15.0

type length 93 +/- to vit. tip distally

90.3 ← or

prox br/depth sh 5/6.2

4.9/5.0

dist " " 3.6/7.3

3.7/6.2

Shankbone like humerus (P. rupestris) minimum Kuhlman 1473
DI4

prox br. 14.7

length as above 83.9 ✓

prox br/depth sh 3.9/5.3

dist " " 3.3/5.7

Oso Dam

Puffins schroderi Shank
120428 br 4.35 dist 3.8/2.8
dist 5.5 " 3.7/2.7

120426 br 6.1

dist 6.1

Oso Dam
Puffins larsoni
120418 br dist 6.4
Puffins 9r 2.7/3.7

Carpometacarpus 120418 8r
length 42.7

Dist. hum 10.1 vit, 9 ext

Shankbone like humerus

shank br 3.8

dist br 6.9+

shank 3.4/4.7

Mitchell?

Loc. 4546

17500
Shankbath. loc 1625

98.1 ————— pos G 15.4
17.8 —————
12.9 ————— dist G, 11.2 (diagonally
11.6 ————— edeph. ht → 10.0 from condyle
6.2 x 4.8 ————— 5.9 x 4.2 sh. bas. mes

type cast inception dist end
dip. 11.8

5.8 x 3.7 oh m. dunkel
10. erkeft brenn " "

6.3×3.8 shown directly.

Depth max low

8.7 through int. fresh to 15

(5TH #175-05)

20920
Lynch 23, 8

9.9

120420 eff/hr sh below prox 5.7x4.1

much larger than the previous 2 ~~values~~

found with burrows 120422

referred to
Mitchell's
Co. xv. 7 ↑

hairs 120415 from 4546 also resemble proser

length 79.3, pin b 15.5 (inc. yg?) dist 7.7 condyle, 11. diag.

rh 9,9 x 6,9 Int. qualche pec. (per distrib. 9,6

from Shunkhath Dell proximal 1503 (La 6688) to 6.5, depth 8.1 NOT crashed

Br. 9120421 - 8.7, depth 8.4

Sh br. 4.0 x 4.8 ~~SH~~ SH 4.2 x 4.8 (E 17503)

Trouble w/ M120421 from 4546 is it's short length. Bone is curved & overlapped
 Total at most length could only be 67.8 (how measure?)

Check
modern
2/20
36.1
67.8

Feb 28, 86

Modern Puffins *frontrondae* Hume

#B559	#543	#543	558
ext length 84.5	84.2	80.0	82.3
wit length 84.8	84.3	80.2	82.5
pin to 14.5	14.0	13.5	14.4
dist to 7.9	8.3	7.5	7.3
mid shaft 59/32	54/33	51/33	52/31
whar length 78.5			

120417 dist 8.0
sh 6.3/3.0

OSI Dan

Locality 4546 vs types	P. californicus	P. mitchelli	120415	120422	120416
type P. frontalis	P. mitchelli	9.1	12.2	9.4	7.8
dist to 7.3	9.4	5.7(2.9)	6.8/3.8	6.0/3.7	7.2/3.7
sh to 6.4/3.2	5.8/3.5				6.6/3.1
			78.2 ext	89.6 ext	90.8 ext
			79.3 int	90.5 int	80.8 (81.5) ext
					81.6 int

Shankbault Hill vs above	18140	10-B-31	4904/593-E	57184	53927	163023
ext 17500	44658	9.4	30.5 ext			
dist 98.2 ext	83.7	81.6 ext				
in center 98.0 int	80.5 int	82.6 int	9.1	8.3	9.1	9.4
dist to 9.0 (9.9)	7.3	7.5	7.0/4.3	6.1/3.0	6.47/4.0?	6.71/4.3
shaft 6.5/4.3 (6.5/4.3)	6.4/3.3	5.6/3.3	6.3/3.3	6.1/3.0	6.47/4.0?	6.71/4.3
width	7	7	7	7	7	7

in center has gr dist breadth continues with narrow rounded shaft
 Mitchell has the gr. dist. but relative deeper flatter shaft
 prunus - californicus ~~has a more distinct shaft~~
 with californicus the smallest of all
 when from Shankbault Hill 88.1 mitchelli? br. 7.6 prun (shaft mid. 5.3/4.5)
 when with Osoburn 120422 br prun 7.0 (shaft curved)
 when 120420 Osoburn length 95.7 (br prun broken) shaft mid 5.1/4.5
 when 120421 " broken in middle (near 6.6) more slender than Shankbault
 olecranon not as developed as in 120420 (muscle end is prun)
 Depth dist end 120421 = 6.0
 " " " 120420 = 6.8 length 95.6 (5.1 x 4.4 sh. middle)
 Shankbault 594-H = 6.2 length 88.1 (5.0 x 4.0 sh. ")
 when 120424 Osoburn prun 6.3 (shape broken)

Puffins

Shenbrot's Hall

Mitchelli humerus 98.3 ✓

puras " 80.3.

Mitchelli? tarsus 58.7-59.3

gusis ~~humerus~~ tarsus 56.6

gusis humerus 104.4 ✓

teniuschis humerus 97.8 ✓

teniuschis tarsus 51.3

Shape of humerus in modern Puffins

4.2 x 7.2	P. ⁵⁰ glaucus	most flattened (br.) with deep (depth)	length 104.4 mm
3.8 x 4.5	P. ¹³⁵⁸ parifera	very round slender shape - bone ^{as} long as girth	100.8 mm
4.5 - 5.2	P. ⁶⁹⁸ creatorius	rounded shaft	113.5
3.9 x 6.1	P. ¹⁰¹⁷⁹³ terrestris	less round than creatorius, less deeply flat than gires	97.8
3.4 x 5.6	P. ⁵⁵⁴ gustavus	" " " " " " " " short	84.1

3.8 x 6.0	P. ¹⁸⁴⁹⁰ priscus	18490 loc 488 suggests of ^{shankbone} gustavus dist 10.5, prox 15.0	82.7
3.3 x 5.9	P. priscus	und. loc 488 S. T. can't measure ends	80.5

4.6 x 6.1	P. ¹⁷⁶⁹⁰ mitchelli	²⁴¹⁶²⁵ somewhat rounder than priscus + longer dist 12.5 since a femur in same but shaft broken prox 17.3	98.4
4.6 x 6.7	P. sp.	10-B-31 Shearwater Hill	98.5?

4.1 x 6	P. sp.	120422 Oso Dam dist 10.4 prox 14.8?	90 approx
---------	--------	-------------------------------------	-----------

cracked so orbanded				
4.2 x 6.4	P. ¹²⁰⁴¹⁵ priscus	Oso	prox? dist 10.5 dist 10.5 prox	79.8 approx
3.6 x 6.3	P. ¹²⁰⁴¹⁶ priscus	Oso	prox? dist 10.8	81.5?
3.6 x 6.4	P. priscus	Oso	prox? dist 10.5	incorrect

3.7 x 5.8	P. ⁹¹⁴ inceptor?	Kulden 914	prox 14.7 dist 11.4 very light dist	83.7
-----------	-----------------------------	------------	-------------------------------------	------

2.8 x 4	Tarsus	Glaucus long slender	56.6 ulna slightly less than humerus	104.4
3.0 x 3.0	"	parifera	48.3 ulna longer than humerus	100.8
3.7 x 3.9	"	creatorius (ulna ^{much as} long as humerus)	54.6 short relative to humerus ^{shorter}	113.5
2.7 x 3.5	"	terrestris long slender	51.3 ulna slightly shorter than humerus	97.8
2.4 x 3.4	"	gustavus short, stub	46.0 " " " " " humerus	84.1

3.4 x 4.8	Fossil Shearwater tarsus	123544	58.7	} longer than all recent spec. ^{dist broken}
3.2 x 4.4	"	"	59.7	

2.7 x 4.6	Oso tarsus	120419	dist 6.3	50++ no prox end
-----------	------------	--------	----------	------------------

Wena #17503 from Sh tooth is narrow peak + has deep oleum
as in *Opuntia*
gusis is broad hlm corymb

March 12 OSO Dam original coll.
85

Puffinus pacificus

①

complete Rt? humerus

4546
120475

Length 79.3

Type 7.5

cond. dist br 7.35

4.1 x 6.5 br depth shaft

but it is cracked + mended

Type broken

depth dist int 8.6

Type 9.5

dist above condyle 9.5

3.2 x 6.1
br. depth sh.
depression on

②

Rt + left humeri and prox? ulna

120416 / 4586

Length 81.2

81.7

condyle br. 7.7

7.5

dist int depth 8.8

8.8

br above condyle 9.5

9.9

ulna prox br. 7.2

" depth 7.5 thru olecranon

Br x depth sh 3.6 x 5.1

One humerus cracked prox 9
giving capital shaft side
greater angulation

Note

P. californicus

from 1945

is more anterior

Br. dist cond 7.8

depth int 7.6

dist above condyle 9.2

2.8 x 5.7

br. depth shaft

depression more marked

③

dist end humerus (pt to dist)

4546 / 120417

dist cond. br 8.1

depth int 8.5

br above condyle 9.6

sh. 3.7 x 6.4

ulna

prox radius

humerus Cpt dist

ulna prox

Br. prox ulna 7.1

depth " 9.2

crushed shaft

Br. br. humerus

R14 SH all

14.4

length R14

83.8

Still

P. pacificus

dist cond. br. 9.2

gr br 10.9 dist

ext depth 7.2

br above condyle 10.1

br depth sh 3.6 x 5.9

Puffinus sp? 4546 / 120422

Length 90.5

prox br 14.8

? dist cond. 9.6 gr br 10.9

x br above cond. 9.9

x int depth broken

my ext depth 6.9

ext depth 7.2 dist

mit shaft 4.1 x 6.0

lower br x depth 3.7 x 6.2

OSO Dam 120422

length dist cond on SH 9.2

SH arch into hum 9.4

and 8.9 to head

humerus has compressed capital shaft ridge

Very deep distal palmar depression

Puffinus sp 4574 / 120420

Length to olecranon 95.7

4.4 x 5.1

Br x depth sh. 8.4

gr br dist

depth dist ext 6.7

ulna complete left?

length 5.4 unnumbered Br 4956

length 88.1

br/depth 4.7 x 5.3 sh.

gr br dist broken

int depth dist 6.15

OSO Dam Puffins

OK ① P. ^{humeri} pusillus - loc 4546/120416 (rt + left)
 humeri Length ⑧ 81.3; ⑨ 81.7
 dist br. ⑨ 11.3 gr, 7.8 condyle; ⑩ 11.0 gr, 7.8 condyle
 prox br ② 14.2; ③ 14.35
 Ht ect. ⑩ 10.1 ⑪ 10.0
 Sh ② 3.3 x 6.4 ③ 3.1 x 6.6

ulna 120424 prox
 prox br 6.4
 n dist 8.0

ulna prox br 7.1 ^{± 4546} 120414
 depth 7.6
phorus

② P. ^{humeri} pusillus loc 4546/120415
 Length 79.2-79.3
 Dist br. (11.0 gr) (2.4 condyles)
 Prox br 13.2??
 Ht ectoph 9.5
 Sh 3.8 x 6

ulna 4546/120421
 w 2 pcs (shaft
 between minuses)
 prox br 6.7
 n dist 8.0
 dist br gr 24
 " " hook only 4.3
 shaft (in dist section middle)
 prox section 4.0/5.2

③ P. ^{humeri} pusillus 4546/120417 incomplete
 Dist br (11.0 gr) (8.0 condyles)
 Sh. 3.0 x 6.4

ulna 120422 prox only
 br 7.0
 depth 9.0
 shaft crushed

④ P. sp? 4546/120422 ^{not like}
 Length 90.5
 dist br. (11.3 gr) (6.4 condyles?)
 Ht ectoph 9.9
 Prox br 14.3-14.6 (mended may make it larger)
 shaft 3.8 x 6.2
 Length deltois crest 17.3

ulna 120426 prox only
 Sh 4.0/4.6 dist 4.6/5.4 (prox)
 prox br 8.52-
 dist br 6.5
 dist br 8.3
 (4546)
 shaft for Sq 44
 dist 88.2

⑤ Raschke 431 unmineralized
 Prox br 15.1
 Dist br (12.4? gr) condyles gone
 Length 92.6 +
 Sh br 3.7 x 7.3

⑥ Raschke (460) Sep 19, 1978
 prox br 13.9
 Sh 3.2 x 6.2 (middle)
 (distal minuses)

ulna 4546/120420
 prox 7.4 + x 8.2
 Length 95.7
 Sh 4.5 x 5.1 middle
 dist depth 6.5
 br hook 5.1 gr 8.3

ulna Rasmussen 1976
 Dist. 3/4
 Depth 55-56 dist
 br dist 2.5 gr (4.2 trochlea)
 ulna Sq 44 complete
 gr length 88.1
 prox 2.6 x 9.4
 dist depth 6.1
 br br 4.7 trochlea only (broken)
 Sh 4.1 x 2.3 (middle)

Puffins bones from Oso Dam

Hammer

- ✓ uncat. ²²² RR431 nearly complete (dist. broken) Loc. ?
- ✓ ⁵²² 120422 complete (with ulna, ulna (see below) + prox radius) Loc 4546
- ✓ 120416 not left complete (with prox ulna) Loc 4546
- ✓ 120415 complete Loc 4546
- ✓ 120417 distal half Loc 4546
- ✓ uncat. RR 400 19 Sept 1988 Loc. ?

- ✓ ulnae prox when incat. call by Joan Bon Apr 23, 1980 Loc 4546
- ✓ 120420 right complete except for ext. styloids (see below) Loc 4546
- ✓ uncat. dist. ³¹⁹ + prox radius LG Barnes 3196 (see below) Loc 4546
- ✓ uncat. distal 3/4 (?) LG Barnes 1976 Loc. ?
- ✓ 120421 prox + dist ends (with middle) Loc 4546
- ✓ 120424 prox only Loc 4546
- ✓ 120422 prox badly warped (with humerus see above) Loc 4546
- ✓ 120416 prox with humeri (see above + left) Loc 4546
- ✓ uncat. distal with ³¹⁹ humeri Apr. 23, 1980 Barnes 3196
- ✓ dist. uncat. LG Barnes 1876 Loc 4547 call 11 Jan 1979

- ✓ 120425 - distal Loc 4546
- ✓ 120426 - distal Loc 4546

Isometatarsus

- ✓ 120419 - dist. 7/8 Loc 4546
- ✓ uncat. - shaft with dist ulna (see above) Apr 23, 1980 Barnes 3196 Loc 4546

Radius

- ✓ 120412 dist Loc 4546
- ✓ 120423 prox + dist separate Loc 4546
- ✓ uncat. prox rad with dist ulna Barnes 3190 (see above)
- ✓ carpalometacarpus Loc 4546

- ✓ 120418 right complete shorter than distal radius (humerus of radius is also shorter + stouter)
- length 42.3
- depth thru M1 10.14
- br. prox 4.44
- ✓ uncat. (with rad + ulna) Barnes 3190

(of 7 males)
add 9 to total of Puffins previously listed Dec 17, 1981

Humerus RR431

Ulna RR 400 (1978) Sept.

Ulna LGB 1976 dist 3/4

dist ulna - Apr 23, 1980

In radius shaft with ulna Apr 23 1980

Barnes 3190 Loc 4546

humerus with dist ulna Apr 23 1980

Over

Albatross from Oso Dam loc 4547

120439 P. mulleri?

juv ulna + distal radius (with partial shaft).

15.8 cm

13.3 depth ant.

Anseriform feather loc 4546 uncalibrated

coll by Mrs Field June 11, 1981

Alcedo?

120414 Zinnia loc 4545 Jan 3 1980 Banner

121010 Coracoa loc 4547 Walter 12 April 1979

120434 ulna loc 4546 Banner April 23, 1980

OSO Dam TO DO en 6.0, depth 6.3 3, 12.85

~~Puffin~~ Puffin tubia 120424 dist loc 4544 lat 2

Puffin " 120423 ^{to 6.0, depth 6.9} dist loc 4546 lat 3

Puffin? radius 120412 Loc 4464 (see 120423)
dist end 1 frag 4 shaft

Puffin ulna 120424 prox loc 4546

Puffin? radius complete? in 2 parts loc 4546 120423

Puffin carpus - complete ~~at~~ loc 4546 120418
length 42.4 prox depth 10.2

3162
mittell SH 123554 tower
sh 3.5 x 4.5
condyles 7? + inc
SH 120419 tower
sh 3.3 x 4.6
dist 6.2 + inc
depth 59.3
3 shaft SH off
to 6 mittelli

Puffin tarsometatarsus dist at 1 sh. 4546 120419 (found?)
br. dist condyle - 6.0 shaft 2.6 x 4.2 +

Puffin ulna in 2 parts 4546 120421
prox 6.7 dist 11.3
depth 8.2

Acrida crassus 4547 12010

Leptidura 4546 120438

lunus 4545 120414

? Crania 4545 120413

Dromedea? milleri loc 4547 # 120439

Ulna prox half at?

radius dist 2 $\frac{3}{4}$ (in 3 parts)

Distend 17. inc
Rensselaer
sh 7.38
7.6 depth

? unidentified distal end femur (crushed) 120438 loc 4546
" " " 120439 loc 4546

" " " 120435 loc 4546
" " " 120435 loc 4546
crushed in matrix (possibly a humerus) that are separate with it
judging from frags

check short flatness +

brochial impression
character for
Puffinus

Shanksooth Hill specimens to check

Puffinus pacificus

Loc 1625 # 44655 no comp humerus ^{up} *P. pacificus* length 81 mm

Loc 6688 # 174562 - 505 humerus (2) ulna prox b. hum. 15,4 mm.

H Loc 3160 # 98476 tarsus long + slender

H Loc 3160 # 98475 prox humerus

Loc 6688 # 18140 complete humerus length 82.7 prox b. 15.0 to tuberosity (ent.)
no ulna process 10.1 (type 10) or condyle 7.4 type 7.3

Puffinus mitchelli

Loc 1625 ^{no} # 17500 - 2 humeri length 98.3 mm

Loc 1655 sp. ? dist ulna 18697

Loc 1625 # 17505 prox ulna sp.

Loc 1655 # 18697 dist ulna sp.

Loc 1622 # 103325 dist humerus with long brochial impression

Remarks:
on ?

Oct 3, 1985

	radius 120422	radius 120422	radius 120422	radius 120422	radius 120422	radius 120422
middle shaft	3.8/6.0	4.2/6.0	3.9/4.5	4.6/5.8	4.2/7.1	3.5/5.1
rust	98.0	90.3	101.1	114.0	104.5	82.7
prox br.	14.5	14.6	15.0	17.6	18.0	14.4
dist br.	10.3	9.6?	8.5	11.8	10.1	8.5

	radius 120422	radius 120422	radius 120422	radius 120422	radius 120422	radius 120422
shaft in dist end	3.8/6.3	3.6/5.9	3.4/5.8	3.4/5.8	3.4/5.8	3.4/5.8
dist end	10.1	10.2	10.1	10.0	10.0	10.0
dist end	9.9	9.9	10.0	10.0	10.0	10.0
dist end	9.0	9.0	9.0	9.0	9.0	9.0
length	14.6	14.6	14.6	14.6	14.6	14.6
prox br.	14.6	14.6	14.6	14.6	14.6	14.6
dist br.	10.3	10.3	10.3	10.3	10.3	10.3

length of radius # 120463 Oso loc 4546 = 62.7
 mod. dist 557 71.0 (chassis 81.7)

length humerus
 radius from
 shaft

$$\begin{array}{r} 6.3 \overline{) 380} \\ 378 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 5.9 \overline{) 360} \\ 354 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 5.8 \overline{) 340} \\ 336 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 7.5 \overline{) 490} \\ 450 \\ \hline 40 \\ 375 \end{array}$$

$$\begin{array}{r} 6.0 \overline{) 380} \\ 360 \\ \hline 20 \end{array}$$

$$\begin{array}{r} 6.0 \overline{) 420} \\ 420 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 4.5 \overline{) 390} \\ 360 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 5.1 \overline{) 350} \\ 306 \\ \hline 44 \end{array}$$

$$\begin{array}{r} 7.1 \overline{) 420} \\ 357 \\ \hline 63 \end{array}$$

$$\begin{array}{r} 5.8 \overline{) 460} \\ 408 \\ \hline 52 \\ 522 \\ \hline 180 \end{array}$$

$$\begin{array}{r} 6.8 \overline{) 390} \\ 340 \\ \hline 50 \\ 500 \\ \hline 476 \end{array}$$

Procellaria form.

Puffins n. St?

Q 50 # 120422 Assoc humerus, ulna radius figs.
Humerus shaft rounded ^{at middle} flat as in quishomela
length humerus 90.3 head below for 3.8

prox breadth 14.7

shaft (mid) 5.8 x 4.3 brk near dist.

distal (diag) 11.3 (straight 9.4?)

ht ectopl 10.1 6.35 x 3.7

length distal 18.6 to head, 16 least

ulna

prox br 7.0 depth 9.2

shaft below prox 3.3 x 4.1 Unlike it is a shaft, dwarf vs
radius prox 4.1 x 4.5, shaft 2.6 x 1.7 (inquire makes it odd)
dist br 5.9, depth 3.8

Humerus has definite
nodule on deltoid at
base (as in Mitchell's
and contains recesses
below this nodule)

Differs from p. pusillus in which
deltoid contour convex
in distal section

Short tooth humerus

P. pusillus or P. mitchelli both have thin, flat
shape especially above distal end - though pusillus is flatter

98475 humerus pusillus
prox br 14.6

Taffinus cf. *pusius*

LACM # 120415 nearly complete humerus

Distal breadth 7.5 (same as type from Sharktooth Hill)

Ht ectepicondylar process from distal end 9.6 (type 9.7)

Shaft dimensions 3.5 x 6.4 (3.5 x 6.3 in type)

Holotype from Sharktooth Hill is incomplete (distal end only). However, other specimens from that locality are presumed assignable to *P. pusius*

These measure 82.5 (#18140 from loc 6888) and 81.3 (#44658 from loc 4546) in length. LACM 120415

See *P. inceptor*

← 84.0 mm (Kishlaw 914) in length. from 4546 only measures 79.3 mm in length.

However, it is very similar to #120416 from 4546 (see below) which is longer

LACM 120416 2 humeri + an ulna (proximal end)

Humerus - length 81.3-81.7 (one is restored)

Distal breadth of condyles 7.3-7.8

Ht ectepicondylar process from distal end 10.0

Shaft dimensions 3.4 x 6.4

Length in Sharktooth Hill #44658 is 81.3

presumably *P. pusius*

Distal br. " " 7.3
Shaft dimensions " " 3.5 x 6.3

Ulna (proximal end and shaft 3/4 - only) crushed

Proximal breadth 7.3. A proximal ulna from

Sharktooth Hill loc 6888 (LACM #17503) has

a proximal breadth of 6.5 (NOT crushed)

The olecranon seems higher in the loc 4546 specimen than in the one from Sharktooth Hill.

Could this be the result of lateral crushing? NO - since breadth is greater than #17503

LACM 120417

Humerus distal end and 3/4 shaft

Breadth of condyles 7.4

Ectepicondylar process 9.3 above distal end

Shaft dimensions 3.6 x 6.6 near distal end

P. pusius
Cast of holotype
ht. condyle 7.3
ect 4.1 9.8
Sh 3.2 x 6.2

Loc. 4546 Humerus Puffinus + ulna

3

Puffinus (try inceptor - Type Shanktooth (Hil))
distal end

LACM 120422

Shanktooth Hil
Refer to inceptor
Killer loc 914 comp.
Humerus
length to ext. margin 88.6
dist br 11.5
prox br 15.0
condyle br 8.1

Humerus length 90.5
br + condyle 89.9

Distal breadth 11.2

Prox breadth 15.0

Shaft dimensions

just above ectepicondylar process 4.1 / 6.8

1st ectepicondylar

process from distal end 10.0

Length deltid crest 16.4

(P. mitchelli 98.1 LACM 17500

P. mitchelli 12.9

P. inceptor cast of type 11.8

P. inceptor cast 4.4 / 6.8

P. mitchelli H 17500 4.8 / 6.2 77%0

P. inceptor 10.0

P. mitchelli 11.1 type

P. praeus? 181406, 6668 17.1

LACM 120422

Ulna associated with above humerus

Very slender - badly distorted

prox. breadth 7.0

just olecranon

Breadth/depth shaft below prox. end 3.1 / 4.0

LACM 120422

Proximal and distal fragments of radius

Distal breadth 5.9 mm

Humerus (120422)
resembles complete humerus from Shanktooth Hil ^{adult} but DI4 as contained
with P. praeus in having a more rounded, less compressed shaft, but
is markedly longer.

- [illegible]

Amur
P. tenuitarsis 101768 (Schmidt coll)

Termination 10/17/93

(4) Sept 99, 7

Sept 98.0

part 2. No. 2-16.5

para Gr. 15.9-16.7

Out hr (12.6 gr) (8.6 condyles)

dist. (8.4) 12.5 gal
condensed

sh 3.6 x 6.2

echin. 10.7 abnorm dist.

Est. Apr 10.7 ht above dirt end

sh 37 x 6.2

P. tenuirostris 10 1746

① SurN 94.5

prob 15.6-

Dist (12.182) (8.4 condyles)

Sh 3.8×6.4 or 3.6×6.3 faulted distal

ectek 10.3

P. Jernumto 101745

Depth 95.2 - 15.3

pay 15.6-15.8

$$\text{dist } 11.7 \text{ gr (8.2 condyles)}$$

On 3.4 x 5, 7

except 10, 8 above dist end

FAMILY Procellariidae

Genus Puffinus -- Shearwaters

Puffinus priscus Miller 1961

Referred Material: From locality LACM 4546: right humerus no. 120417; associated left and right humeri and right ulna no. 120416; distal end of right humerus no. 120417; uncatalogued proximal 3/4 of humerus (collected by R. Raschke, 19 Sept., 1978; right tarso-metatarsus no. 120419. 120415 (79.3g dist, 7.8 dist to proximal 9.6)

Discussion. The humeri agree in size and conformation with the holotype distal end of this element from Sharktooth Hill and/or additional specimens from that locality now ~~xxxxxxxxxx~~ at hand. The tarsometatarsus is assigned on the basis of size in comparison with tarsometatarsi from Sharktooth Hill. There are three tarsometatarsi in the Sharktooth Hill collection, ~~xxxxxxxxxx~~ one of which is slightly smaller than the other two and is believed to be assignable to P. priscus. ~~xxxxxxxxxx~~

Puffinus .n. sp.

Referred material: From locality 4546, associated right humerus, proximal ulna and proximal and distal ends of radius, no. 120422; and uncatalogued humerus collected by (R. Rasche (loc?)) date?

Discussion.

Puffinus? dist radius loc 4546 coll Barne 7 May 1980

120412 left hum length 79.2, dist h. 7.6 coll. Jean Brown 23 April 1980 (4546 Barne 3198)

120414 " " at hum. radius (R. 7.4, dist 7.8 mm) length 81.1 and 81.7 [4546 Barne 187]

120416 " " at hum. radius (R. 7.4, dist 7.8 mm) length 81.1 and 81.7 [4546 Barne 187]

120417 dist. at hum. coll Barne (3189) 2 Apr. 1980 loc 4546

120419 at tarsus (dist radius) coll Barne (3189) 2 Apr. 1980

120422 complete radius loc 4546 length 47.6 coll Elaine Hearn. (Barne 1987) 1979

120421 prox. at ulna 6.8 x 8.1 (LGB 3151) coll by RL Puer L. G. Barne 18 Dec 1979

120424 prox ulna left 6.3 x 7.9 h. depth prox 10.1 (Barne 3199) coll by Barne 23 April 1980

120425 dist. at ulna left 6.3 x 7.9 h. depth prox 10.1 (Barne 3199) coll by Barne 23 April 1980

120426 complete ulna except ext. styloid length 95.7 prox depth 9.1 dist 6.5 ext

120418 at carpalometatars length 42.4 depth prox

120422 humerus (ext) length 96.4, br. dist 85.3 h. depth 4.1/6.0

prox ulna 7.0 x 8.9

124360 (56.97g) dist. at ulna (left) depth ext 66.5 loc. 4546 McKenais 29 May 1979

124361 (56.97g) dist. at ulna (left) depth ext 66.5 loc. 4546 McKenais 29 May 1979

124362 (56.97g) dist. at ulna (left) depth ext 66.5 loc. 4546 McKenais 29 May 1979

124363 (56.97g) dist. at ulna (left) depth ext 66.5 loc. 4546 McKenais 29 May 1979

Check loc. 1945
loc. 17549
41/550 by 735 prox
compare same series
to new 00
Shot Hill
Also loc. 1945
loc. 17549
41/550 by 735 prox
compare same series
to new 00
Shot Hill
Also loc. 1945
loc. 17549
41/550 by 735 prox
compare same series
to new 00
Shot Hill

120415 humerus prox?
loc 4546
uncat. humerus
4546

Jim 11/79
coll Barne
120412
120414
120416
120417
120419
120422
120421
120424
120425
120426
120418
124360
124361
124362
124363

same sp
flatter shaft

Separate

16 May

distal

QRM

4346-L

4546-L

TABLE

Measurements of specimens assigned to the genus Puffinus

	P.priscus holotype	Humerus P.priscus 1625/ 1625/44658 shkHill	P.priscus Oso Dam	p.mitchelli SHT Hill
90.4 Length	-----	80.23 - 82.2		98.1
Prox. br.	-----	14.6 - 15.3		
Dist. condyles	7.4	7.1 - 7.5	7.5 - 7.9	12.9
Shaft			54/55 ⁹⁰	3.6/6.6 (51 ⁹⁰)
br/depth	3.3/6.3		3.5/6/4 + 3.4/6.4	3.5/6.3 35 ⁹⁰
Ht. ect-epicond	8.1 9.7	8.9-10.0	9.6-10.0	11.1 type
		Ulna		
	Shark tooth complete	Oso Dam complete	Sharktooth	Oso ends
Length	88.2	95.7		
prox.		6.5		7.3
dist. br condyles				
dist. dep.				
br/dep sh.				

$$\begin{array}{r} 68 \\ 60 \overline{) 410} \\ \underline{360} \\ 500 \end{array}$$

$$\begin{array}{r} 51 \\ 66 \overline{) 360} \\ \underline{330} \\ 100 \\ \underline{99} \\ 1 \\ 63 \overline{) 350} \\ \underline{315} \\ 350 \end{array}$$

Pugginus sp.

REFERRED MATERIAL.

Shankbark Hill Papilio

① *Papilio* Sh Hill 10-B-31
Br. dist. end (gr. 13.6) (condyle 8.9)
diag.
Ht. ectop. above condyle 12.0
Shaft 4.4 x 7.0

② *Papilio* ? *mitcheilli* loc. 1625 ± 17500
Br. dist. end (13.2 gr.) (condyle 8.9)
diag.
Ht. ectop. above condyle 11.0
Shaft 4.2 x 6.6

③ *P. ? priscus* loc. 4956 (uncatalogued)
Length 80.7
Br. dist. condyle 8.3 (broken for gr. h.)
Ht. ectop. above condyle 9.5
Shaft 3.1 x 6.2

④ *P. ? priscus* loc 1625/44658
Length 80.4 - 80.9
Br. dist. end (gr. 11.0) (condyles 7.3)
Shaft 3.5 x 6.7

⑤ *P. ? priscus* 6688/18140
Length 82.6 - 82.7
Br. dist. (11.4 gr.) (condyles 7.6)
Shaft 3.4 x 6.4
Plex br. 14.5 - 14.8
Ht. ectop. above distal end 9.8

multitype *P. priscus* ✓
Pz dist 7.5 (condyle)
Br. sh. 6.3
Hindwing sh 3.5
Ht. ectop. 9.7
Length 80.8 - 82.7 sexual female

Kubland 914

??
Length 83.8
Pz dist (gr 11.5) (condyles 7.9)
Ectop. 10.2
Sh 3.7 x 5.7
Plex br 4.8 - 4.9
Length 83.8 - 84.0

END May

Loc 3140
50706

pur br 7.0?

gr. dist 13.2 gr. (9.2 condyle)

6688/17502

pur 14.7 - 15.3

dist 11.4 gr. (7.7 condyle)

Sh 3.3 x 6.5

Whea 4956/17504 distal end

depth dist 6.3

br dist tooth 4.6

gr. dist 7.8

Whea 4956 (unmarked)

gr. dist 88.2

Br / depth pur 7.6 / 9.1

sh 4.1 x 5.3 middle

distal end 186.97 / loc 16.35

depth 6.3

gr. br 8.6

br. tooth 4.8

<i>P. microps</i>	<i>P. callimachus</i>	<i>P. Ganus</i>
10.0	7.2	7.7
6.0	5.75	5.8
3.5	2.9	3.6
10.1	9.3	9.5

88?? Length
(with del. 501
in air, with
priscus sh. 5
from SH Hill)

~~Puffinus pacificus~~
Shank's Hall

Two humeri 17500 assigned to *P. mitchelli* by HT
resemble *P. tenuirostris* ^{moder} in length but shaft is heavier

and brachial crest is longer and (in palmar view)
has a more rounded contour (with sub-marginal groove)

Type mitchelli	Length	tenuirostris 101793	<i>P. mitchelli</i> 17500	<i>P. griseus</i> 1118	Small med. 50	Shank's Hall sh. 10.3.31 wz.
—	98.0	98.0	98.2	100.5-104.9		
11.1	humeri condyle	10.3	11.5	11.3	11.6	12.0
	dist. br. diag.	12.7	13.3	12.5	13.7	13.5
8.5	dist br. condyle	8.5	9.0	8.6	9.0	9.1
	br/depth sh			3.6/6.3	7.0/7.5	4.2/2.2
4.2/7.0	dist	3.7/6.1	4.2/6.6	3.7/6.1	4.2/7.2	4.5/6.9
—	mid.	3.9/6.0	4.5/4.3	4.3/5.9	4.9/7.1	5.0/6.8
—	prox	4.3/4.0	5.0/6.1			

I find no humeri to match the above
(including *mitchelli*) in the OSO Dam materials

± RR431 95.5 off length 3.6 x 7.1 sh (dist'ly) 7.7/6.6/prox
120422 96.5 length 3.7 x 6.2 (dist'ly)
11.2 diag dist'ly 4.2 x 6.0 (mid sh) 4.7 (5.6 prox)
9.8 htr condyle

Oct 10
1985

3(1) Puffinus ? n. sp.? 120422 (35) under humerus ulna radius

X 1 Puffinus sp. 121350 left ulna ①

X 1 Puffinus 2 pieces 120421 rt ulna in 2 parts - lcr 45-46

X 1 " " 120424 left ulna prox lcr 45-46

~~Puffinus sp. 120420 smaller than 120421 lcr 45-46 120421~~

X 1 Puffinus sp. 120420 complete rt ulna large lcr 45-46

X 1 Puffinus sp. 120418 - rt carpus lcr 45-46

✓ 1 Puffinus fuscescens left humerus 120415 lcr 45-46

✓ 2(1) Puffinus purus rt & left humeri rt ulna 120416 lcr 45-46

✓ 1 Puffinus purus rt dist humerus 120417 lcr 45-46

✓ 1 Puffinus fuscescens rt tarsus (metatarsals) 120419 lcr 45-46

X 1 Puffinus sp. rt dist tibia 120425 lcr 45-46

X 1 Puffinus sp. left " " 120426 lcr 45-46

X 1 Puffinus cf purus complete radius 120428 lcr 45-46

X 1 Puffinus sp. distal end radius 120412 lcr 45-46

X 1 Puffinus sp. left ulna prox ulna uncat. 45-46

X 1 Puffinus sp. left ulna prox ulna uncat. 45-46

✓ 1 Puffinus purus prox rt humerus uncat. 45-46

★ write up Puffinus sp. (base) nearly complete humerus uncat. 45-46

X 3(1) Puffinus sp. assoc. fragments radius, carpus, dist ulna uncat. 45-46

X 2(1) Puffinus sp. assoc. fragments dist ulna, shaft tarsus uncat. 45-46

5(1) Sula - 120433 rt & left humerus, rt & left radius (ulnae) 45-46

1 120429 radius only 45-46

21 120425 left humerus fragments & left car. uncat. 45-46

1 120427 skull 45-46

1 120431 humerus uncat. rt tarsus (? Sula websteri) 45-46

1 120432 humerus uncat. 45-46

2(1) 120435 rat + ulna 45-46

1 120438 humerus 45-46

7(1) 120439 radius (clavus) 2 parts see note in list 45-46

colls Burns, Welton, McKinnon, Raymond L. Price (with Burns), Joan Brown, Rodney Raschke, Diane Weiss, Rebecca Berge, Claire Heron (with Burns)

Puffinus
californicus
type

1 humerus #120422
OSO Dam Loc 4546
23 April 1980

120416
2 humeri
Jan. 11, 1979
both mended
81.1 and 80.9

dist
humerus
Apr 2, 1980

length ext	89.8 (90.5 quarter)	3.5	3.1	3.8 expanded due to cracks	2.34
2.9 br sh	7.1	6.35	8.6	6.0	6.3
5.8 depth sh	6.0	10.4	9.55	9.8	9.9
9.3 ht extepi	10.0 (bare)	9.5	—	—	—
	10.1 (tip)	8.8	—	—	—
br. dist	11.2 (diag)	11.2	10.9	11.2	11.0
6.9 br. cond sh	br. sh	7.6	7.8	7.5	8.3 expanded due to cracks

	#51	1375	#60	18873	698
	ofurtho	panties	grains	grains	arealys
ext length	82.2	100.7	106.8	118.2	113.4
br sh	3.2	3.9	4.0	4.6	4.8
depth sh	4.3	5.0	7.2	6.3	5.9
ht extepi	9.7	9.7	11.8	11.7	11.7
br. dist (diag)	10.8	11.2	14.1	13.8	13.55
br cond sh	7.2	8.4	9.2	10.0	10.0

Sh T Ice Puffins Lumen

44658 length lumen 80.9 dist 7.25

88140 " " 82.6 " " 7.3 prob 14.9

17800 " " 98.3 " " 8.9 " " 17.3

Lobolyth mitchelli h dist 9.1 sh to depth 3.8/6.8

" " " " 7.3 " " 3.2/6.2

" " " " 6.9 " " 2.9/5.8

103325 dist 7.5